



ASANSOL INSTITUTE OF ENGINEERING AND MANAGEMENT - POLYTECHNIC (AIEM-P)

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"LEADING YOU TOWARDS A BRIGHT FUTURE"

TECHNICAL MAGAZINE



Civil
Engineering



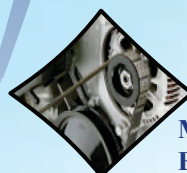
Mining
Engineering



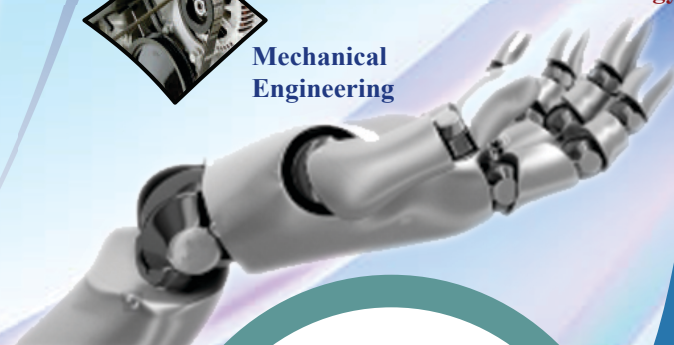
Electrical
Engineering



Computer Science
& Technology



Mechanical
Engineering



SPARKLE ' 2023

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Asansol Institute of Engineering and Management-Polytechnic

2023-24



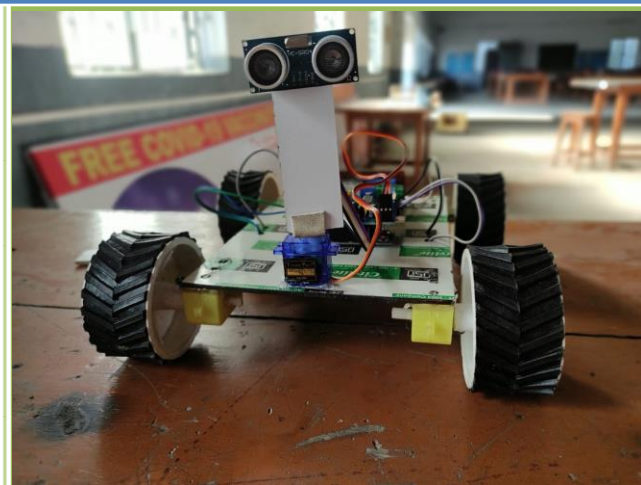
Technical Magazine “Sparkle 2023”

Vision

AIEMP is driven to provide excellent educational opportunities that are responsive to the needs of our students, and empower them to meet and exceed challenges as active participants in shaping the future of our world and also to meet the growing technological & socioeconomic needs of our nation.

Mission

- Improvement of fundamental skills in Maths, Science, English and basic engineering for the students.
- Provide our faculty necessary opportunity to attend FDP.
- To arrange training for the students in industry to develop their industry orientation and make them industry ready and also provide them necessary in house orientation for higher studies.
- Imbibing values, ethics, character, courage and patriotism in the teaching learning to help students blossom as future national leaders.



Message from Director



“We want that Education by which character is formed, strength of mind is increased, the intellect is expanded, by which one can stand on one’s own feet.”

By Swami Vivekananda

It is a noble task on the part of the Asansol Institute of Engineering and Management-Polytechnic to once again make it with their frequent issue of their Technical Magazine “Sparkle’2023”. I wish that this “Sparkle’2023” establishes to be a flint to fire the enthusiasm and excite their minds for many intrusive innovations among the students and inspire passion among the members of the faculty of AIEM-P committee. The efforts taken by Dr. Lisha Misra, Principal, Mr.C.R.Rout, Academic Advisor, Mr. Tanmoy Singha, Dean Academic and all the HODs and HODs Incharge to bring about innovative content is appreciable.

My greeting to the editorial board to keep the good work.

With Best Wishes

H.N Misra
Director
Asansol Institute of Engineering and Management-Polytechnic

Message from the Principal



"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela.

It is a matter of great pride and satisfaction for Asansol Institute of Engineering and Management –Polytechnic to bring out the Technical Magazine **"SPARKLE'2023"**. The College has made tremendous progress in all areas academic, non-academics, capacity building relevant to staff and students.

I am confident that this issues of Technical Magazine **"SPARKLE'2023"** will send a positive signal to the staff, students and the person who are interested in the Technical education and Technology based activities. The Technical Magazine **"SPARKLE'2023"** is like a mirror which reflects the clear picture of all sorts of activities undertaken by all Department and develops writing skills among students in particular and teaching faculty in general.

I congratulate the Editorial Board of this Technical Magazine **"SPARKLE'2023"** who have played wonderful role in accomplishing the task in Record time. I express my deep sense of gratitude to Mr. Tanmoy Singha, Dean of Academic and all the HODs and HODs In-Charge under whose guidance this Technical work has been undertaken and completed within the stipulated time.

Also my heartfelt Congratulations to staff members and Students for their fruitful effort.

With Best Wishes.

Dr.Lisha Misra
Principal

Asansol Institute of Engineering & Management-Polytechnic

Message from the Academic Advisor



We make technocrats, who proudly can say 'I am an AIEM-Pian Engineer; I serve mankind, by making dreams come true.'

It gives me an immense pleasure to note that the Asansol Institute of Engineering and Management –Polytechnic is bringing out the Technical Magazine “Sparkle’2023”.

Learning is a continuous process from the minute we are born, until we die." AIEM-P provides a platform for every student to develop his learning skills through this magazine.

It will foster our budding talents who have expressed their thoughts, ideas, hopes, feelings, aspirations and convictions in a creative way to reach the goal called “Sparkle’2023”. The student’s articles contributed for the Technical Magazine “Sparkle’2023” has shown their intellectual insight and their excellent command on Technical Knowledge

This magazine should be a good source of guidance for faculty and coming batches of students in choosing activities of their choice in their future for building their carrier.

I congratulate all the HODs and HODs Incharge, Teaching and non teaching staff, editorial board members and students of the AIEM-P for bringing this edition of Technical Magazine “Sparkle’2023” within the stipulated time.

Wish you all the best.

A handwritten signature in black ink on a light-colored background. The signature appears to read "Chittaranjan Rout".

C.R.Rout
Academic Advisor
Asansol Institute of Engineering & Management-Polytechnic

Message from the Dean Academic



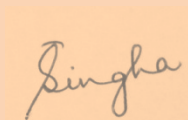
“Where there is a will there's a way?”

by George Herbert

Providing ample opportunities in Diploma engineering education is one of the most fundamental obligations we owe to our students because in Asansol Institute of Engineering & Management-Polytechnic (AIEM-P) we are driven by the belief that every student deserves a high quality education.

Sparkle'2023 provides an intersection of great challenge and great opportunity for the students to review their efforts and to analyze their achievements in research and development. Technology is evolving at a dizzying rate and our classrooms may not be designed to keep pace with it. There may be a lot wrong in the style of education but the pages of “SPARKLE'2023” tell the tale of all that have been a part of what is right about the education they get in AIEM-P.

I congratulate the team of students and the faculty for their tireless efforts that have come to fruition in the form of this Technical Magazine-“SPARKLE'2023”. I wish it all success and hope that this tradition that has been set by the current students will be carried through by the following generation of students to come. I have no doubts in near future AIEM-P will be termed as one of the leading technical institution in our state.



Tanmoy Singha
Dean Academic
Asansol Institute of Engineering & Management-Polytechnic

Message from the HOD (Mining Engg.)



“Our future Success is directly proportional to our ability to understand, adopt and integrate new Technology into our work”

by Sukant Ratnakar

It's my heartfelt good wishes to all associated with the publication of the first ever technical magazine “SPARKLE’2023”. Technical magazine is the mirror of technical activity of an institutes to the world. The article in the magazine highlights the emerging trends in Science and Technology. This is very knowledgeable and informative. I am sure that the students will be immensely benefited. Hope this trend will continue in coming years.

Thanks to Mr.Tanmoy Singha, Dean Academic, for his untiring effort to bring out this technical magazine.

My special thanks to our Hon’ble Director Sir and Principal Madam for their continuous inspiration which yielded this beautiful magazine.

Lastly blessings and thanks to the student for their wonderful articles which really sparked the Sparkle’2023.

A handwritten signature in cursive script that reads "Sankha Sarkhel". The signature is written in dark ink on a light-colored background.

Dr. Sankha Sarkhel
HOD (Mining Engineering)
Asansol Institute of Engineering and Management-Polytechnic

Message from the HOD (Computer Science & Technology)



A College Technical magazine “SPARKLE’2023” is an eloquent expression of the progress and outstanding that a college has to its credit. It’s a manual that highlights the quality of education and extra-curriculum that a college undertakes to develop all round personality of the students. I am sure that the students of AIEM-P will be benefitted to a large extent by the content of the Technical Magazine “SPARKLE’2023”.

I heartily congratulate all those who have taken pain to bring out this technical magazine adding glorifying and colorful petals to a wonderful flower called AIEM-P.

A handwritten signature in black ink, appearing to read "Rana Chakraborty", on a yellow rectangular background.

Rana Chakraborty
Administrative Officer
Asansol Institute of Engineering & Management-Polytechnic

Message from the HOD In-Charge (Mechanical Engg.)



On behalf of Mechanical engineering department, Asansol Institute of Engineering and Management- Polytechnic, I am pleased to announce the launching of the 1st Volume of Technical Magazine “SPARKLE’2023”. This Technical Magazine aims to disseminate information focusing on application of existing technology, practical explanations and developments in latest trends and techniques which will thrive our student’s mind-set towards recent technology.

A handwritten signature in orange ink that reads "Abhisek Mitra".

Abhisek Mitra
HOD In-charge (Mechanical Engineering)
Asansol Institute of Engineering and Management- Polytechnic

Message from the HOD In-Charge (Civil Engg.)



It gives me immense pleasure to express my views on the release of Technical Magazine- “SPARKLE’2023”. I feel extremely happy through this Technical Magazine that our students will be definitely encouraged towards the recent trend and new technology. Besides, our budding talents have expressed their thoughts, ideas, hopes, feelings, aspirations and convictions in a creative way.

The student’s articles contributed for the Technical Magazine has shown their intellectual insight and their excellent command on language. Once again, my message is: “Aim always High”, as high as the sky to be good citizens and leaders of our beloved country.

A handwritten signature in black ink on a yellow rectangular background. The signature reads "Munmun Roy" in a cursive script, with a stylized flourish at the end.

Munmun Roy

HOD In-Charge (Civil Engineering)

Asansol Institute Of Engineering and Management-Polytechnic

Message from the HOD In-Charge (Basic Sci. & Hum)



It gives me great pleasure to know that “SPARKLE’2023”, AIEM-P Technical Magazine 2023-2024 is ready for publication. True to its name, this magazine gives an insight into the range and scope of the imagination and creativity of our students and faculty members.

I applaud the editorial team for the hard work and dedication they have invested in realizing this goal, and wish my dear students success in all future endeavors.

A handwritten signature in black ink on a light-colored background. The signature is stylized and appears to read 'Debashis Banerjee'.

Debashis Banerjee
HOD In-Charge (Basic Science & Humanities)
Asansol Institute of Engineering & Management-Polytechnic



Chapter-1

Technical Magazine

Sparkle'2023

Electrical Engineering Department

Name of the Editors:

- 1. Mr. Tanmoy Singha (HOD)**
- 2. Mr. Pranabesh Mukhopadhyay (Lecturer)**

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1. FUEL CELL

Author Name: **Md. Rashid Ahmed, 5th SEM**

A **fuel cell** is an electrochemical device that converts chemical energy into electrical energy and heat without any combustion. Fuel cell systems generally operate on pure hydrogen and air to produce electricity with water and heat as bi-products. It requires continuous supply of fuel and oxidant to produce DC electric power.

A fuel cell is a device that generates electricity by a chemical reaction. Every fuel cell has two electrodes called, respectively, the anode and cathode. The reactions that produce electricity take place at the electrodes. Every fuel cell also has an electrolyte, which carries electrically charged particles from one electrode to the other, and a catalyst, which speeds the reactions at the electrodes. Hydrogen is the basic fuel, but fuel cells also require oxygen. One great appeal of fuel cells is that they generate electricity with very little pollution—much of the hydrogen and oxygen used in generating electricity ultimately combine to form a harmless byproduct, namely water. The purpose of a fuel cell is to produce an electrical current that can be directed outside the cell to do work, such as powering an electric motor or illuminating a light bulb or a city. Because of the way electricity behaves, this current returns to the fuel cell, completing an electrical circuit. The chemical reactions that produce this current are the key to how a fuel cell works. There are several kinds of fuel cells, and each operates a bit differently. But in general terms, hydrogen atoms enter a fuel cell at the anode where a chemical reaction strips them of their electrons. The hydrogen atoms are now "ionized," and carry a positive electrical charge. The negatively charged electrons provide the current through wires to do work. If alternating current (AC) is needed, the DC output of the fuel cell must be routed through a conversion device called an inverter.

Oxygen enters the fuel cell at the cathode and, in some cell types, it there combines with electrons returning from the electrical circuit and hydrogen ions that have traveled through the electrolyte from the anode. In other cell types the oxygen picks up electrons and then travels through the electrolyte to the anode, where it combines with hydrogen ions. The electrolyte plays a key role. It must permit only the appropriate ions to pass between the anode and cathode. If free electrons or other substances could travel through the electrolyte, they would disrupt the chemical reaction. Whether they combine at anode or cathode, together hydrogen and oxygen form water, which drains from the cell. As long as a fuel cell is supplied with hydrogen and oxygen, it will generate electricity. Even better, since fuel cells create electricity chemically, rather than by combustion, they are not subject to the thermodynamic laws that limit a conventional power plant (see "Carnot Limit" in the glossary). Therefore, fuel cells are more efficient in extracting energy from a fuel. Waste heat from some cells can also be harnessed, boosting system efficiency still further.

2. ENERGY MANAGEMENT SYSTEM

Author Name: **Rahul Chauhan, 5th SEM**

The basic idea of integrated energy plan is to prepare an area based decentralized energy plan to meet energy for development of non-conventional energy source. Centralize energy planning exercise not pay attention to the variations in socioeconomic and ecological factor. To utilize the resources efficiently, decentralized energy planning is one of the main criteria. The regional planning implements various resources available and demand in a region. Planning of Integrated energy provides better decision making, involvement of all stakeholders. Energy demand management is also known as demand side management as well as demand response

An **Energy Management System (EMS)** is basically a system of computer-aided tools used by operators of electric utility grids for monitoring, controlling, and optimizing the performance of generation. SCADA is known as the monitor and control functions. To reduce energy consumption, improve the utilization of the system, increase reliability, predict electrical system performance, and optimize energy usage to reduce cost this intelligent energy management software control system is designed. ETAP (EMS) Energy Management System applications use actual generation, tie-line load flows, real-time data such as frequency and plant units controller status. There are many objectives of an energy management software, including an application to maintain the frequency of a Power Distribution System and keeping tie-line power close to the scheduled values. In ETAP's Energy Management System, scheduled values are maintained by adjusting the MW outputs of the AGC generators so as to accommodate varying load demands. The energy management software application will also calculate the required parameters to optimize the operation of the generation units under energy management action.

For the reliable and efficient operation of power systems Electrical energy management systems (EMS) are an important function. Real time operation, control and monitoring of a power system is related to the EMS. Remote Terminal Units (RTUs), an integral part of SCADA read the information from the power system and send to an EMS or Energy Control Centre (ECC). EMS consists of both hardware and software. RTU, Intelligent Electronic Device (IED), Protection, Computer networking, are hardware part of EMS. Software part of EMS consists of Application programs for network analysis of power systems. In EMS, application programs are run in a real time as well as extended real time environment to keep the power system in a secure operating state. Now-days, in any power system EMS is an integral part of it. It is used as a part of Substation Automation System (SAS), Demand Side Management (DSM), Protection, and Distribution Management Systems (DMS) for renewable energy and so-on. In the coming years, EMS-DMA will bring a change in the role of power systems, monitoring and control. Demand side management is also known as Energy demand management. Energy demand management entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy-supply systems are constrained. It is not that peak demand management necessarily decrease total energy consumption. To reduce the need for investments in networks and/or power plants demand management could be expected. Today demand response is known as demand side management.

3. GEOTHERMAL ENERGY

Author Name: **Simran Verma, 5th SEM**

The interior of the earth consists of central molten core surrounded by a region of semifluid material called MANTLE. This is covered by the CRUST, which has a depth of 30 to 90 km. The temperature in the crust increases proportionally to depth at a rate of 30degree C/km. The average rate of release of geothermal energy from within the earth is around 0.063W/m².

The word 'Geothermal' comes from the Greek words geo (earth) and therme (heat). It means the heat of the earth. This is thermal energy trapped beneath and within the solid crust of the earth. This energy exists in the form of steam, hot water, and /or hot and molten rock. It is released naturally in the form of geysers, hot springs and volcanic eruptions.

Geothermal energy comes from two sources. It includes primordial thermal energy which was present when the earth was formed as well as thermal energy produced from the decay of heavy radioisotopes within the earth. Geothermal energy sources are generally comes in following categories:

- (i) Hydrothermal energy sources are those associated with steam and hot.
- (ii) Petrothermal energy sorces that are associated with hot rocks.
- (iii) Geo-pressumed systems occur high temperature water under high pressure.

There are about more than 300 known hot springs in India, located in the Himalayan Mobile belt.

The areas with the highest underground temperatures are in regions with active or geologically young volcanoes. These "hot spots" occur at tectonic plate boundaries or at places where the crust is thin enough to let the heat through. The Pacific Rim, often called the Ring of Fire for its many volcanoes, has many hot spots, including some in Alaska, California, and Oregon. Nevada has hundreds of hot spots, covering much of the northern part of the state.

These regions are also seismically active. Earthquakes and magma movement break up the rock covering, allowing water to circulate. As the water rises to the surface, natural hot springs and geysers occur, such as Old Faithful at Yellowstone National Park. The water in these systems can be more than 200°C (430°F).

Seismically active hotspots are not the only places where geothermal energy can be found. There is a steady supply of milder heat—useful for direct heating purposes—at depths of anywhere from 10 to a few hundred feet below the surface virtually in any location on Earth. Even the ground below your own backyard or local school has enough heat to control the climate in your home or other buildings in the community. In addition, there is a vast amount of heat energy available from dry rock formations very deep below the surface (4 - 10 km).

Geothermal energy has the potential to play a significant role in moving the United States (and other regions of the world) toward a cleaner, more sustainable energy system. It is one of the few renewable energy technologies that can supply continuous, base load power. Additionally, unlike coal and nuclear plants, binary geothermal plants can be used a flexible source of energy to balance the variable supply of renewable resources such as wind and solar.

However, in order to tap into the full potential of geothermal energy, two emerging technologies require further development: Enhanced Geothermal Systems (EGS) and co-production of geothermal electricity in oil and gas wells.

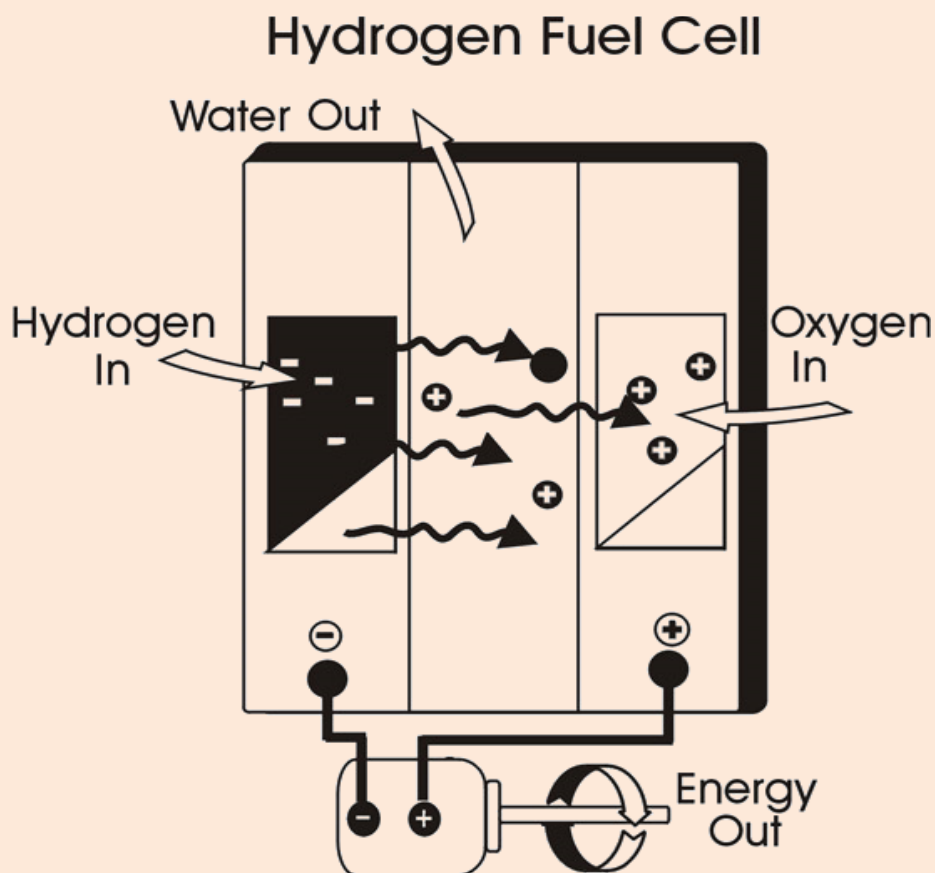
4. HYDROGEN ENERGY

Author Name: **Roshan Prasad, 5th SEM**

Hydrogen is most abundant element in nature and always found in the form of compounds. The richest source of hydrogen is water. It is an odourless, colourless and tasteless gas. Hydrogen can be produced by renewable and non-renewable sources. It can be stored as a fuel and used in transportation, I.C. engines or turbines. It can be converted in liquid form. Because of no impact on environment hydrogen as an energy can play an important role as alternative to fossil fuels.

Hydrogen can be burned for **heat energy** or it can **produce electricity directly** within fuel cells. **Most of the hydrogen in use today was derived from natural gas.** Almost all of the hydrogen on Earth is only found in combination with other elements such as oxygen, carbon, and nitrogen. To use hydrogen, it must be separated from these other elements.

Hydrogen is one of two natural elements that combine to make water. Hydrogen is not an energy source, but an energy carrier because it takes a great deal of energy to extract it from water. It is useful as a compact energy source in fuel cells and batteries.



The most effective way to convert hydrogen into oxygen is using a fuel cell. A fuel cell converts chemical energy into electrical energy. A fuel cell enables hydrogen and oxygen to blend in an electrochemical reaction. The result is production of electricity, water, and heat. Fuel cells mimic batteries since they both convert the energy generated by the electrochemical reaction into useful electric power. Nonetheless, the fuel cell will generate electric power as long as fuel, mainly hydrogen, is available.

Fuel cells represent a potential technology for use as a source of electricity and heat for buildings. It's also a promising source of power for electric and hybrid vehicles. Fuel cells function best on pure hydrogen. However, other fuels such as gasoline, methanol, or natural gas can be reformed to generate the needed hydrogen for fuel cells.

With technology moving fast, hydrogen could come on par with electricity as a vital energy carrier. An energy carrier transmits energy to the customer in a ready to use form. Some renewable energy sources such as wind and sun may not be able to generate energy around the clock, but are able to produce hydrogen and electric power and stored for later use.

Advantages

Whether hydrogen is burned for heat or is used in fuel cells, **the only material by-product is water**. Although water vapour is a greenhouse gas, it is very short-lived in the atmosphere and is kept in balance by the hydrologic cycle (i.e. excess water vapour falls from the sky as precipitation).

Difficulties

There are **four key problems** with using hydrogen as an energy source:

1. It takes **energy to produce** hydrogen
2. Hydrogen has a very **low energy density**
3. It is **difficult to store** and handle
4. It is difficult and **expensive to transport**

5. SOLAR PHOTOVOLTAIC - BASIC & APPLICATIONS

Author Name: **Adarsh Mishra, 5th SEM**

Solar cells, the basic unit block of a solar photovoltaic systems, comprises of two or more especially prepared layers of semiconductor materials processed with an additive that causes the device to become photosensitive. When photons strike the surface of the solar cell, electron hole pairs are released, thus generates *Electricity*.

Solar cell, also called **photovoltaic cell**, any device that directly converts the energy of light into electrical energy through the photovoltaic effect. The overwhelming majority of solar cells are fabricated from silicon. Solar cells can be arranged into large groupings called arrays. These arrays, composed of many thousands of individual cells, can function as central electric power stations, converting sunlight into electrical energy for distribution to industrial, commercial, and residential users. Light falls on upper surface which is n-type (cathode) and the valance electron gets excited and move into the conduction band and through the top metallization moves to the negative terminal and thus flows out to the external circuit into the anode terminal which is at the bottom surface and p-substrate. It is important that exposed part (upper surface) of PV cell has to be perpendicular to the incident radiation coming from the sun. Only then the particular P-N junction will act as a generator. In practice PV cells never have identical i-v characteristics. In practical situation, out of the total PV cells mounted on the roof top some PV cell is under shed because of nearby buildings and trees etc. Hence short circuit current of PV cells under sun light is much more than those PV cells which are under shed. Solar cells, whether used in a central power station, a satellite, or a calculator, have the same basic structure. Light enters the device through an optical coating, or antireflection layer, that minimizes the loss of light by reflection; it effectively traps the light falling on the solar cell by promoting its transmission to the energy-conversion layers below. The antireflection layer is typically an oxide of silicon, tantalum, or titanium that is formed on the cell surface by spin-coating or a vacuum deposition technique. The three energy-conversion layers below the antireflection layer are the top junction layer, the absorber layer, which constitutes the core of the device, and the back junction layer. Two additional electrical contact layers are needed to carry the electric current out to an external load and back into the cell, thus completing an electric circuit. The electrical contact layer on the face of the cell where light enters is generally present in some grid pattern and is composed of a good conductor such as a metal.

Solar cell panels also are used to provide electric power in many remote terrestrial locations where conventional electric power sources are either unavailable or prohibitively expensive to install. Because they have no moving parts that could need maintenance or fuels that would require replenishment, solar cells provide power for most space installations, from communications and weather satellites to space

stations. Solar power is insufficient for space probes sent to the outer planets of the solar system or into interstellar space. Solar cells have also been used in consumer products, such as electronic toys, handheld calculators, and portable radios. Solar cells used in devices of this kind may utilize artificial light (e.g., from incandescent and fluorescent lamps) as well as sunlight.

6. LIGHTING IN WORK PLACE

Author Name: **Himanshu Singh, 5th SEM**

The quality of lighting in a workplace can have a significant effect on productivity. With adequate lighting workers can produce more products with fewer mistakes, which can lead to a 10-50 % increase in productivity. Good lighting can decrease errors by 30-60 % as well as decrease eye-strain and the headaches, nausea, and neck pain which often accompany eye-strain. Adequate lighting allows workers to concentrate better on their work which increases productivity.

The level of lighting that workers need varies depending on the nature of the task, the sharpness of the workers' eyesight, and the environment in which the work is done. For example, detailed work, such as inspection, assembling of small parts or technical drawing, needs a great deal of light. Coarse work, on the other hand, such as loading or unloading materials, handling of materials or packaging, requires less light.

Good lighting in the workplace promotes:

1. a reduced risk of occupational accidents and health problems;
2. better concentration and accuracy in work;
3. a brighter, cleaner workplace resulting in a more active, cheerful environment;
4. improved work performance;
5. better visibility, improved accuracy and increased work speed enhancing production.

It can be easy to improve lighting without increasing the number of light bulbs, light fixtures or the electric bill. Improved lighting can be achieved by using more daylight, by changing the position of light sources or workstation layouts and by effectively using reflected light.

Consider the following guidelines when planning to improve the lighting conditions in your workplace:

1. Determine the problem:

- a. Talk to workers and find out if they suffer from headaches, neck pain, or nausea, all of which may be caused by eye-strain. Ask if they have difficulty seeing their work. It is essential to implement safety activities with the workers' full cooperation as they might have very positive ideas for improving safety and productivity. The worker doing the job can best evaluate the impact of a change;
- b. See for yourself if there are any obvious lighting problems. If workers have their eyes unnaturally close to the object they are working on, it is likely there is a problem, or if workers feel

there is a need to make extra efforts to make out details when it is cloudy, rainy or at certain times of the day;

- c. Consider alternative solutions which are best adapted to the company's capacities. Take these into consideration before implementing an improvement;
- d. Get advice and observe a similar improvement under similar conditions in another enterprise or workplace;
- e. Make small but continuous improvements by trying out the idea first on a small scale to see how it works;
- f. Consider quick implementation of ideas that can be put into practice immediately to demonstrate positive change.

Here are some low-cost measures which promote a safe working environment, reduce the workload and increase productivity. These measures are easy to implement in small and medium-sized enterprises.

Make Full Use of Daylight

Natural lighting is most effective in improving illumination. Using daylight improves morale and it is free. Examine the workplace layout, material flow and workers' needs, then try out the tips on how to make good use of daylight:

1. provide skylights, for example by replacing roof panels with translucent ones;
2. equip the workplace with additional windows;
3. place machines near windows;
4. move work requiring more light near windows.

Consider the following before planning and installing windows and skylights:

1. consider the height, width and position needed for windows or skylights. More light is available when the window is placed high on a wall;
2. install shades, screens, louvers, canopies or curtains on the windows and skylights to protect the workplace from external heat and cold while taking advantage of the natural light;
3. orient skylights and windows away from direct sunlight to obtain constant but less bright light;
4. direct skylights and windows toward the sun if variations in levels of brightness throughout the day do not disturb workers;
5. avoid storage or placement of flammable liquids in direct sunlight as the magnification of the sun's heat may lead to vaporization of the liquid and increase the risk of fire.

Use Local Light

The use of local light has many advantages. Local lighting requires less power to get adequate brightness since brightness is decreased exponentially by the distance from a light source. Here are some suggestions for maximizing the use of local lighting:

1. place and direct light the way it seems best for the work being performed;
2. light up the spot where light is needed;
3. use mobile stands or flexible arms to enable directing light where it is needed;

4. select the correct direction of the light to prevent annoying shadows and glare;
5. the effects of different directions of lighting are as follows:
 - i. lighting from the back of an object helps to distinguish it from its background;
 - ii. lighting coming from an upper angle clearly reveals the shape and surface texture;
 - iii. direct lighting from the front may clearly reveal surface markings but the ability to see texture is reduced;
6. add or take away local lighting as necessary to obtain the optimum level of lighting;
7. combine general and local lighting by providing the minimum required light with general lighting and add just lighting levels at specific locations using local lighting.

Paint Ceilings and Walls in a Light Colour

Light colours create more reflection than dark colours. Light colours make it easier to keep ceilings and walls clean. Glossy white painted surfaces reflect 100% of the light whereas black surfaces reflect no light at all. To achieve improved illumination, follow these recommendations:

1. use white or a very light colour on ceilings;
2. paint walls white;
3. use light or half-tone colours on tables and machines.

Choose an Appropriate Background

The background at the workstation is important, especially for visual tasks that demand close, continuous attention. A simple background will allow for more accuracy and an increase in production whereas a complex background may disturb the work and increase the workload. To obtain an optimum visual task background:

1. eliminate potential sources of distraction, such as posted papers, forms or schedules on walls;
2. use light-coloured partitions and screens to eliminate or screen sources of distraction;
3. select an appropriate colour for the work background. The following table provides some guidance for making this selection:

Material	Appropriate background colour
steel, cast iron	cream coloured
bronze, copper	grey-blue
light-coloured wood	dark
aluminium, tin	cream coloured
dark wood	grey-blue
ground castings	light

Eliminate Shadows and Glare

Shadows and direct or indirect glare reduce lighting, make it difficult to work and decrease productivity. Glare is usually caused by light from lamps, skylights and windows. Here are some low-cost suggestions to eliminate shadows and glare:

1. change the position of light sources;
2. change the position of the workstation;
3. use multiple light sources by mixing direct and reflected light;
4. use lamp shades which reflect light upwards, since reflected light from ceilings provides the best visibility;
5. provide lamp shades with a white inside and black inside-edges;
6. use lamps with a movable stand or a flexible arm to easily change the direction of light;
7. use a magnetic clamp stand with a clip to easily change the position of the lamp;
8. hang lamp shades and use light sources with a relatively large surface area such as fluorescent lamps to obtain even general lighting with less glare;
9. construct skylights and windows on the non-sunny side to obtain an evenly lit working area;
10. provide blinds, curtains, louvers, trees and vines to shade the building;
11. use matte paint or darker colours for all surfaces (for example, tables, machines, tools);
12. install screens, covers or partitions for shielding strong light which produces glare;
13. combine daylight from windows and skylights with ceiling and local lights to reduce sharp shadows and glares and to achieve optimum lighting conditions.

Provide Separate Electric Switches

Separate and individual electrical switches allow workers to switch off unnecessary lamps resulting in considerable savings on electricity. Consider the set tips:

1. supply separate and individual switches for each general lighting fixture and for local lights or a group of lamps;
2. install switches within easy reach of workers;
3. install switches which are easy to operate;
4. assure that each local light has its own plug allowing it to be easily moved according to work requirements;
5. provide an individual plug and socket at the workstation to reduce the need for extension cords and reduce the potential for having entangled wires which can result in dangerous situations.

Maintenance of Lighting

Periodic maintenance is important for productivity and cost-savings. Lamps give off less brightness when they are dirty but still consume the same amount of electricity. If lamps, skylights, windows, ceilings, walls and work areas are maintained in good condition, lighting can be improved without increasing the number of fixtures or light bulbs. In a dusty workplace, light coming from windows is reduced 30-40% after three months and 45-55% after 6 months. Therefore it is important to:

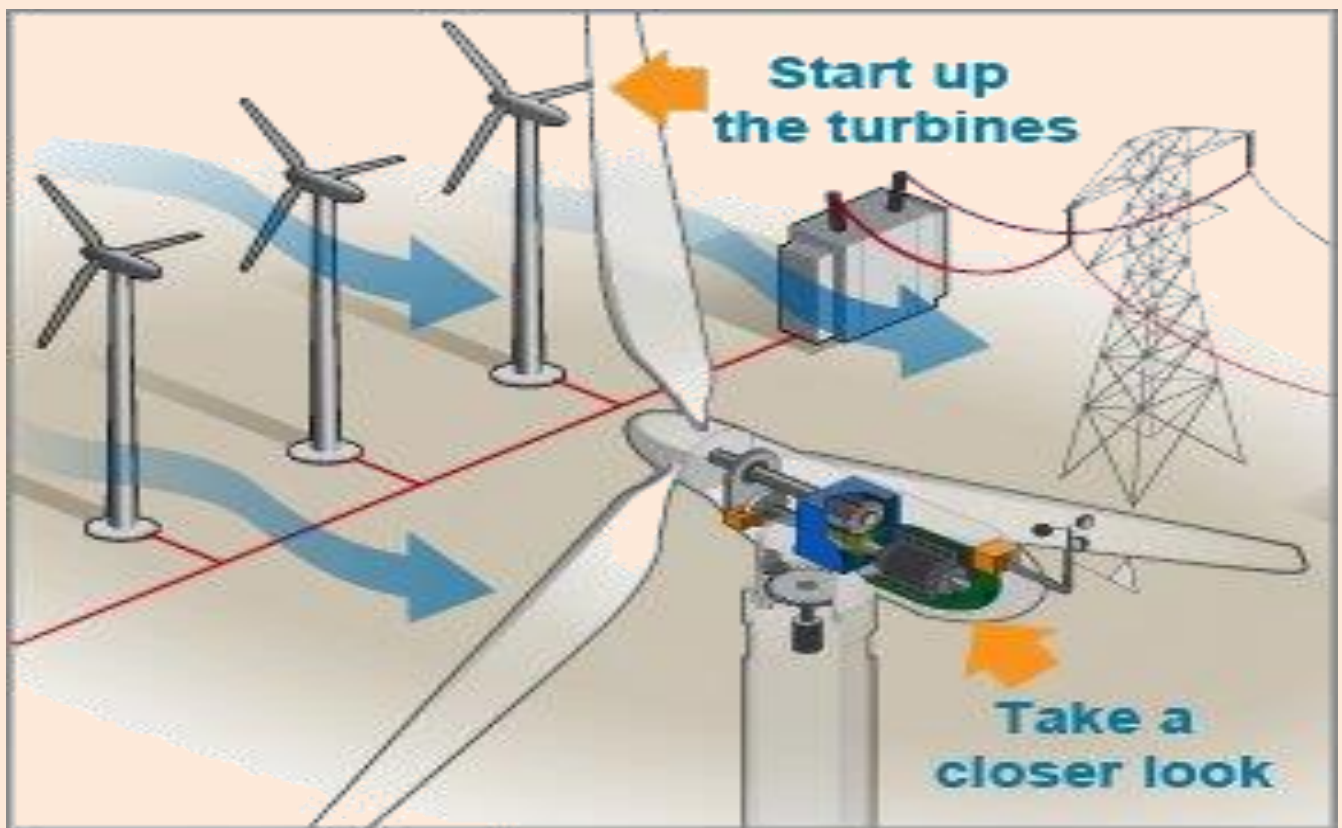
1. clean all the essential elements in workplace at regular intervals;
2. replace light bulbs and tubes which have blown or are reduced in brightness;
3. place light bulbs which have reduced in brightness at another workstation where less light is required;
4. use open top type lamp shades to prevent dust from collecting on light bulbs and tubes

7. WIND ENERGY

Author Name: **Swagata Halder, 3rd SEM**

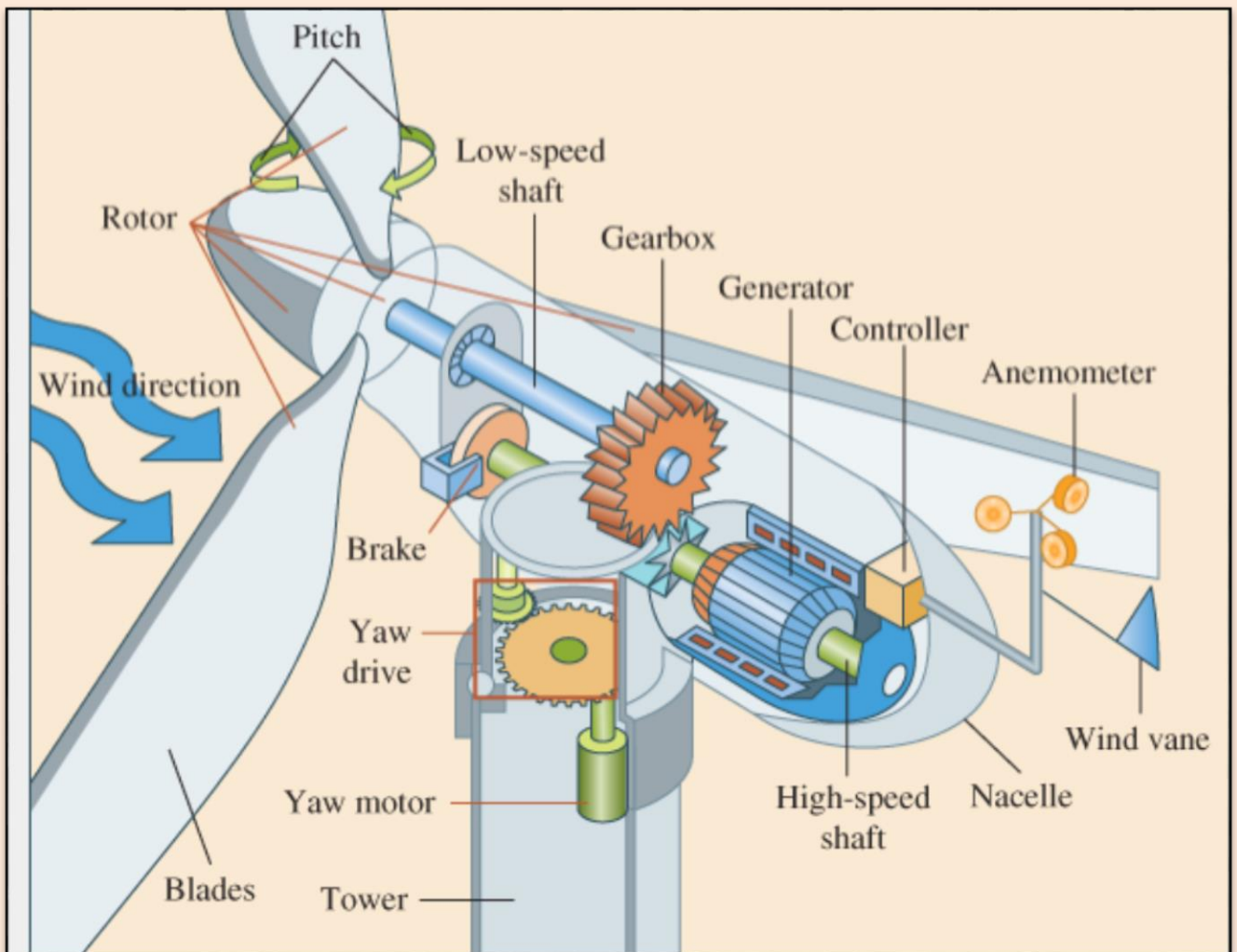
Winds are generated due to the atmospheric temperature difference caused by different areas getting different fluxes of sunlight. Air mass tends to move from hotter to the cooler regions, thereby generating winds. The amount of energy contained in the wind at any given instant is proportional to the wind speed at that instant. Wind speed increase with height. The lift forces act perpendicular to the direction of air flow, while drag forces act in the direction of air flow.

A windmill is a mill that converts the energy of wind into rotational energy by means of vanes called sails or blades. Windmills are of two types, horizontal axis windmills and vertical axis windmills. In horizontal axis windmills, the axis of rotation is parallel to the direction of wind. In vertical axis windmills, the axis of rotation is perpendicular to the direction of rotation.



A wind turbine converts the kinetic energy of the wind to rotary mechanical energy. Blowing wind spins the blades of a wind turbine. When the wind blows, a pocket of low pressure air form on the downwind side of the blade. The low pressure air pockets then pull the blade toward it, causing the rotor to run. This is called lift. The force of the lift is actually much stronger than the wind's force against the front side of the blade, which is called drag. The combination of lift and drag causes the rotor to spin like a propeller. The rotor of the turbine is attached to a hub that is mounted on a turning shaft. The shaft goes through a gear transmission box where the turning speed is increased. The transmission is attached to a high speed shaft which turns a generator that makes electricity. The electricity thus obtained is depending on the end

user's need, either alternating or direct. Direct current can be generated by driving brushless D.C. generator attached to the windmill's rotor.



The Blades and the Mechanical Stage

Blades play a part in the wind turbine principle by combining with the pillar that goes down to the generator. Every time they are revolved, they impart some mechanical energy on the middle part of the structure, which is shaped like a rod with coils upon it. These turn anticlockwise to the spin of the wing-like devices above in order to impart this energy through friction to the generator below. The latter is able to convert the sent waves into power that can be stored in terms of volts.

The wind turbine principle would be incomplete without touching on the strengthening significance of the whole structure in enabling the whole process. The structure or turbine is usually laid on firm ground with a strong foundation to prop it against uprooting. In this way, it is barricaded with metal against any strong force that can cause its anticlockwise mechanism to crumble.

8. LI-FI (LIGHT FIDELITY)

Author Name: **Souvik Auddya, 3rd SEM**

The Li-Fi (Light Fidelity) innovation was proposed by the German Researcher Harald Haas. The primary capability of this innovation is to communicate the information through light. This innovation is ideal for fast remote correspondence in a limited district, and it offers many advantages over Wi-Fi innovation like high data transmission, convenience, proficiency, and security. These frameworks can impart from streetlamps to auto-steered vehicles thinking carefully. As the light speed is prevalent subsequently the information correspondence speed is likewise quicker in the current framework. Moreover, this innovation can be executed for expedient information access for the PCs, and devices that will be sent during the shaft in a room.

What is Li-Fi Technology?

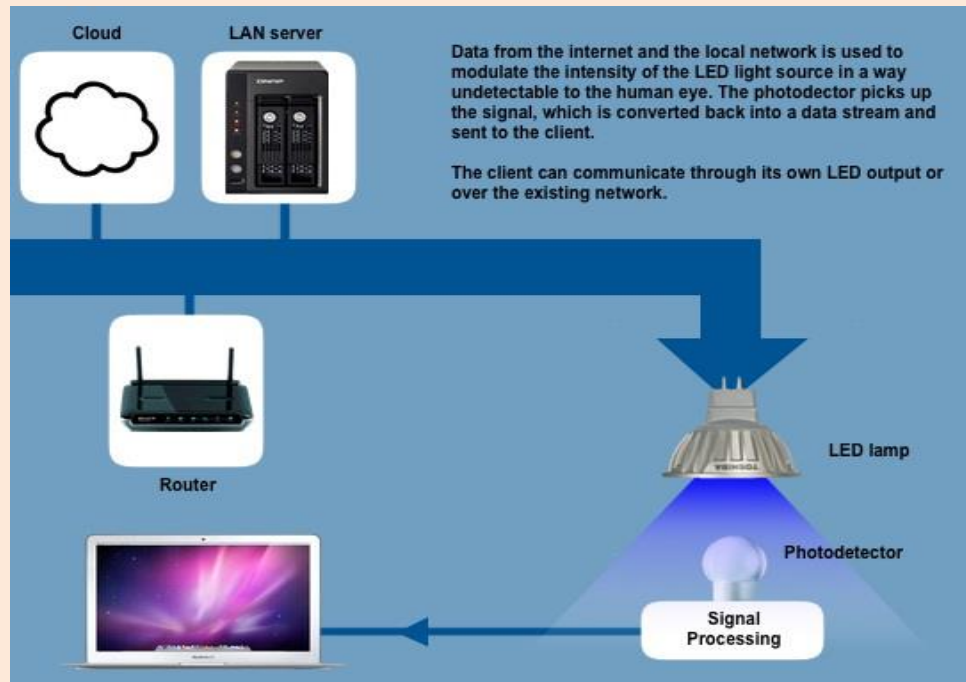
Li-Fi-light loyalty is like Wi-Fi innovation and it is one representing things to come remote correspondence advancements. The primary component of this innovation incorporates completely organized, bidirectional and fast remote. These days, the most moving space in remote correspondence is Wi-Fi and web clients are likewise being expanded consistently. For acquiring better speed, proficiency, data transmission, Li-Fi innovation has advanced. The information transmission in this innovation should be possible utilizing light on the grounds that the light power changes faster than the natural eye for catching. The scope of information transmission in L-Fi is quicker multiple times than Wi-Fi.

System Block Diagram for Li-Fi

A Li-Fi device primarily consists of two components: a transmitter and a receiver. The input signal at the transmitter section may be modulated over a predetermined time period before being converted to 0s and 1s and used to transfer data. Here, 0s and 1s are used to represent the LED lights' flashes. A photodiode is used at the receiver end to receive the LED flashes, amplify the signal, and provide the output.

The transmitter section of the Li-Fi system's block diagram contains an input, a timer circuit, and an LED bulb. Any type of data, including text, audio, and more, can be entered into the transmitter. The time intervals between each bit are provided by the timer circuit in this part, and they are sent to the recipient end as LED flashes. Both an amplifier and a photodiode are found in the receiver portion.

Here, a photodiode detects the flashes from an LED bulb and converts them into electrical impulses. The amplifier then amplifies the impulses after receiving them from the photodiode to produce the output.



How Li-Fi Operates?

Visible light communications, or VLC, is what Li-Fi is and it has a very fast speed. Li-Fi increases the speed of data transmission to 224 Gigabits/sec using standard LEDs. This technique allows for the use of illumination for data transmission. Bright light emitting diodes are the key components of this technology.

Advantages of Li-Fi:

- Li-Fi has a very high speed, so we can view videos without any buffering.
- Security: Because the Li-Fi light does not pass through the barrier, it is more secure and hacking is impossible.
- Safe-Li-Fi uses light pulses, which are not dangerous.
- Consistent: The transfer of data is better secured.

Disadvantages of Li-Fi:

- Aside from a few advantages, the Li-Fi innovation is dealing with a few issues. It requires LOS (view), as well as the collector, wouldn't be a move in inside.
- The fundamental issue is the means by which the recipient will send the information back to the transmitter segment and It doesn't work in the faint regions.
- One more weakness of this innovation is an obstruction of outside light sources like typical bulbs; daylight in the path of correspondence will cause recess in the transmission.

9. OPTICAL ILLUSION

Author Name: **Sourav Das, 3rd SEM**

An optical illusion that is perceived by the eyes and then comprehended by the brain in a manner that is distinct from reality is known as an optical illusion. The brain creates a "whole" image from individual elements because it needs to define reality based on simple, familiar objects. The picture is just a design of black and white shapes, not a vase or two silhouettes. But the brain makes its own version of the image because it wants to understand it based on other images it has seen before; It either produces faces or a vase in this particular instance.

There are three categories of visual illusions that are widely known. These are the literal illusions, cognitive illusions and physiological illusions.

A literal Illusions

An optical illusion that creates images that are different from the things that form them is called a literal illusion. Here's an illustration of a real illusion.

Cognitive Illusions

A cognitive illusion is a type of illusion that alters the experience's information and presumptions about a physical element or object and its surroundings. German physician Dr. Herman Helmholtz proposed that a cognitive illusion appears when one's worldview interacts with their views and assumptions, leading to unconscious inferences.

There are four categories of cognitive illusions that are generally accepted by psychologists: (1) geometrical-optical, (2) ambiguous, (3) fiction, and (4) paradox.

In geometrical optical illusions, the length, form, size, curvature, and/or position are all distorted. These also go by the name of distorting delusions. The Ponzo illusion, the Muller-Lyer illusion, and the Cafe Wall illusions are three examples of common distortions.

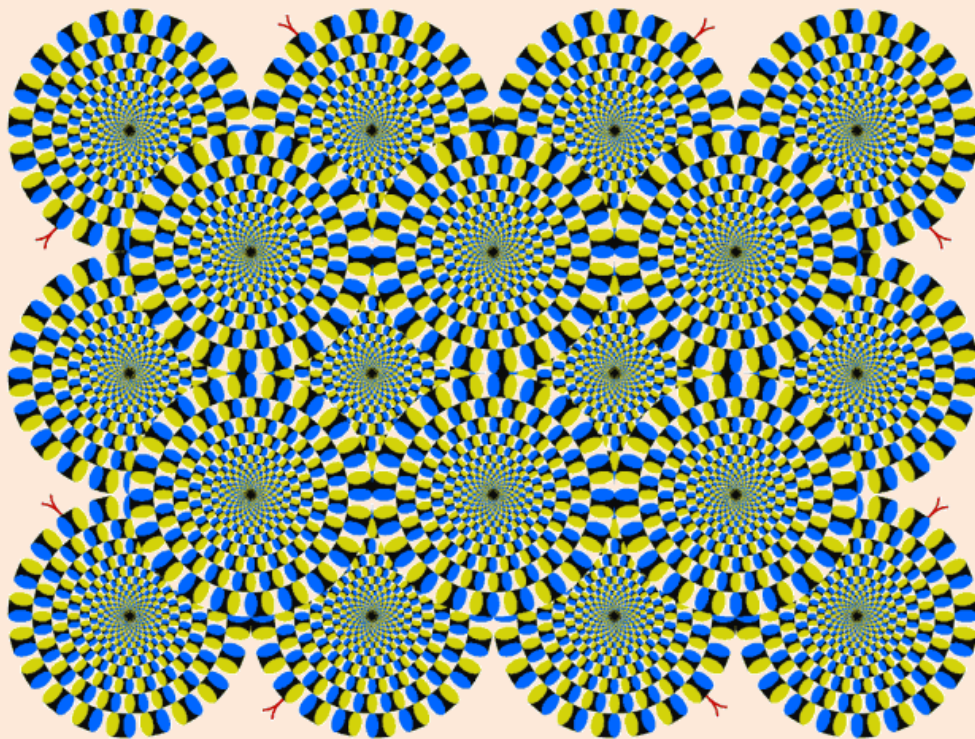
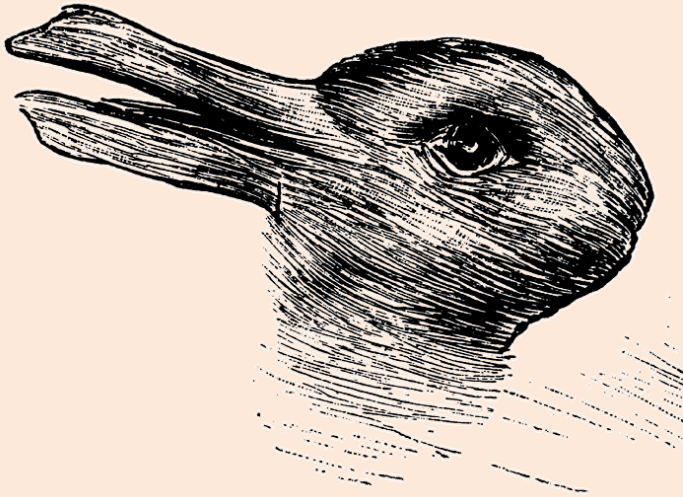
Ambiguous Illusions: Images of things that cause a perceptual level switch between potential alternatives are called ambiguous illusions. The so-called "impossible objects" are among these deceptions. The Necker cube, which can be seen below, is the most well-known instance of an ambiguous mirage.

Fiction illusions are deceptions that lead people to believe a person is present when it is not. Here is an illustration of a fictional mirage.

Paradox Illusions: Illusions created by paradoxical or improbable things are known as paradox illusions. The parallelogram of Penrose.

Physiological Illusions In physiological illusions, the brain assumes that the image is the result of excessive physical stimulus interaction or stimulation. This stimulus can compete with or contextualize a particular color, brightness, size, movement, or other aspect.

Some famous photos of Optical illusion



10. OPTICAL CHARACTER RECOGNITION

Author Name: **Santanu Karmakar, 3rd SEM**

Over the past decade, electronic document management systems have been of great benefit to society. Software tools such as word processors, computer aided design (CAD) packages, drawing programs, and mark-up languages are extensively used in the generation, storage and retrieval of documents in a format understood by computers. In this format a document can be easily edited, copied on papers, or may be distributed electronically across world-wide networks. Additional processing tools are available when the document is in a computer readable or understandable format. On the other hand, when the documents are on paper, none of the above tasks can be accomplished by the use of computers. There is a bulk amount of documents on papers that are to be processed for various reasons. It has been estimated that approximately 250 billion USD per year is spent, worldwide, on keying information from paper documents and this is for keying only 1% of the available documents. Most of this cost is in human labor. Typing by human operators for rapid transfer of printed and handwritten information into computer readable format is time consuming and prone to error. This operation has recently been ameliorated by the invention of Optical Character Recognition (OCR) techniques. OCR is an essential technique that enables the transfer of printed documents to a computer readable form.

OCR allows for the automated archiving and retrieving of old documents, especially old books. OCR has various applications at this time and still has great potential, as it offers a variety of applications for mail sorting, bank cheque processing, reading machines for the blind, automatic number plate recognition and handwritten text recognition among other uses. OCR research studies have a great influence on pattern recognition applications, for example; face recognition , fingerprint recognition, iris recognition, understanding and recognizing engineering drawings, research and industrial use of robotics. Recently, some systems have integrated OCR with new research topics such as automatic translation and voice commands. These systems would play an important role in developing such new topics. OCR research topics are part of many other broad research areas. These broad research areas are artificial intelligence, machine learning, computer vision, digital image processing, pattern recognition and natural language processing. Artificial intelligence facilitates computers to carry out tasks which are usually done by people, thus, enabling computers to recognize documents rather than people is considered to be an artificial intelligence approach Machine learning is concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as databases. The feature detection and extraction phase is considered to be a machine learning methodology.

Computer vision aims to duplicate the effort of human vision by electronically perceiving and understanding an image. The machine extracts important information from the image which enables the solving of some tasks in order to understand the image.

Digital image processing is the processing of digital images by digital computers. The digital image is composed of a fixed number of elements. Each element is a pixel on the image and has a location and value. Most of the steps of OCR handle the document image as a digital image and use different algorithms - usually applied in image processing. Pattern recognition is concerned with defined pattern domains (such as iris, fingerprint, voice and face) and extracts some features from this pattern (either geometrical or structural) and then applies a classification algorithm to identify the pattern based on previous known examples. OCR is a branch of pattern recognition and the domain, in the case of OCR, is the text. Natural language processing (NLP) is a common research topic involving computer science and linguistics. It is

concerned with the computers' processing of human (natural) languages. This computer processing is generated using language engineering algorithms. OCR uses language engineering in generating and exploiting corpora. There are many commercial OCR applications in the market with different prices and degrees of accuracy. These applications are commonly used with the English language. The character recognition accuracy, page layout reconstruction, support for languages, support for PDF output, speed and user interface are the main features that differentiate between OCR applications (Simple Software 2012). From various OCR applications in the market, ABBYY FineReader 11 (ABBYY 2012), OmniPage Professional 18 (ScanStore 2011) and Readiris Pro 12 (IRIS 2011) were considered to be the best OCR applications in the market. NovoVerus from Novo Dynamics (Dynamics 2012) and OCR from Sakhr software (Software 2011) were first known Arabic OCR applications.

Optical Character Recognition (OCR) Model

OCR can be described as Mechanical or electronic conversion of scanned images where images can be handwritten, typewritten or printed text and the objective is to classify the input character as per the predefined character class. The whole OCR system is an aggregation of several units working in unison. Generally, OCR system consists of four major blocks viz., Preprocessing, Feature extraction, Classification, and Post processing [Fig. 1].

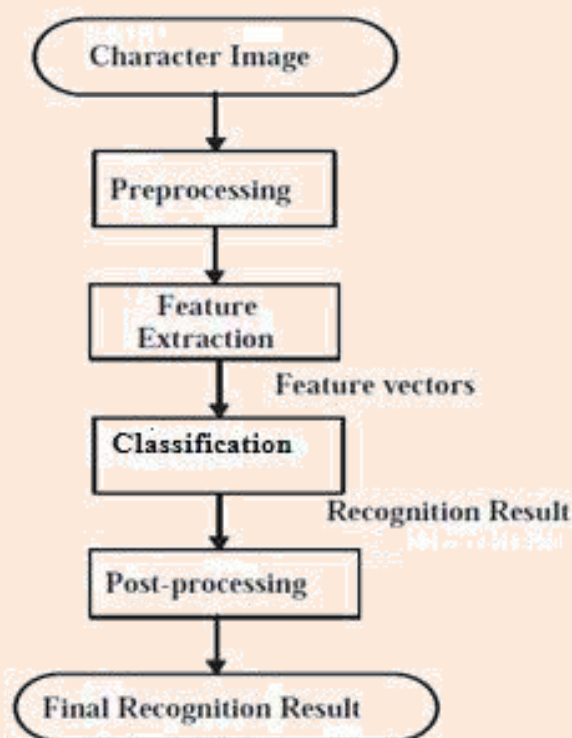


Fig.: A general Optical Character Recognition system

The pre-processing stage includes computer vision algorithms. It makes the direction of character strokes more prominent which contains important information for character recognition. If the strokes in certain directions that occur at certain positions could be precisely described in the character image, the character will be easily categorized. Feature extraction quantifies the attributes of image for proper classification. The results of classification can be further improved by Post-processing thereby increasing the recognition accuracy.



Chapter-2

Technical Magazine

Sparkle'2023

Mechanical Engineering Department

Name of the Editors:

- 1. Mr. Abhisek Mitra (HOD in-Charge)**
- 2. Mr. Prasenjeet Mukherjee (Lecturer)**

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1. Friction Stir Welding

Author Name: Deba Prasad Puitandy

Semester: 3rd

Friction stir welding (FSW) is a solid-state joining process that uses a non-consumable tool to join two facing work pieces without melting the work piece material.



Principle of operation

The FSW is performed with a rotating cylindrical tool which has profiled pin (also known as a probe) having diameter smaller than the diameter of shoulder. During welding the tool is fed into a butt joint between two clamped work pieces, until the probe pierces into the work piece and shoulder touches the surface of the work pieces.

Advantages and Limitations :

A number of potential advantages of FSW are:

- Good mechanical properties in the as-welded condition.
- Improved safety due to the absence of toxic fumes or the spatter of molten material.
- No consumables — A threaded pin made of conventional tool steel, e.g., hardened H13, can weld over 1 km (0.62 mi) of aluminum, and no filler or gas shield is required for aluminum.
- Easily automated on simple milling machines — lower setup costs and less training.

Some disadvantages of the process are:

- Exit hole left when tool is withdrawn.
- Large down forces required with heavy-duty clamping necessary to hold the plates together.
- Less flexible than manual and arc processes (difficulties with thickness variations and non-linear welds).
- Often slower traverse rate than some fusion welding techniques, although this may be offset if fewer welding passes are required.

Welding forces:

- A downwards force is necessary to maintain the position of the tool at or below the material surface. Some friction-stir welding machines operate under load control, but in many cases the vertical position of the tool is preset, and so the load will vary during welding.
- The traverse force acts parallel to the tool motion and is positive in the traverse direction. Since this force arises as a result of the resistance of the material to the motion of the tool, it might be expected that this force will decrease as the temperature of the material around the tool is increased.



Joining of aluminum 3D printing material

FSW is proven able to be used as one of the methods to join the metal 3D printing materials. By using proper FSW tools and correct parameter setting a sound and defect-free weld can be produced in order to join the metal 3D printing materials.

2. Importance of Technology for Engineering Students

Author Name: Binayak Sahoo

Semester: 3rd

Importance of Technology:-

Technology has become an inseparable part of almost every aspect of today's life especially Engineering Colleges. In terms of education also, it is bringing about massive change in the way it is imparted.

As a teaching aid, the advent of technology was not an immediate step. It highly adopts by educational institutions like AIEM-P. They gradually came to realize its importance in imparting education.

The use of technology has been given a whole new meaning to education. However, the educational system has completely transformed by adopting technological advancements. The Combination of technology and education have brought upon a revolution in the sphere of learning for the greater good.

Benefits of using Technology In Education

Over the years a great number of studies and research has been conducted. It shows various benefits of the use of technology in education at Best Engineering Colleges in West Bengal. The technology should enhance learning rather it should implement the improvement of our education system in order to enhance learning. The mixture of technology and education opens up endless possibilities. Thus, the use of technology brings about various delivery methods. It has access to a massive amount of information, global interaction to enhance learning and excellent examples through simulations and model.

3. Recent Advancement in Manufacturing Process

Author Name: Deep Kumar Dutta

Semester: 3rd

Manufacturing processes have undergone numerous advancements over the past few decades, driven by technological advancements and the need for more efficient and sustainable production methods. One of the most significant advancements in manufacturing processes is the integration of automation and robotics. Automation has been a game-changer in manufacturing, making production processes more efficient and cost-effective. Robotics, in particular, have played a critical role in advancing manufacturing processes. They are used in many manufacturing processes, such as welding, painting, and assembly, to name a few. Robotics can perform tasks with precision and accuracy, which can increase production speed while reducing the risk of errors.

Another major advancement in manufacturing processes is the use of additive manufacturing, also known as 3D printing. This technology allows manufacturers to produce complex components and parts that were previously difficult or impossible to produce using traditional manufacturing methods.

With 3D printing, manufacturers can create parts layer-by-layer, allowing them to create intricate designs with ease. Furthermore, advancements in material science have also contributed to the improvement of manufacturing processes. For example, the development of lightweight materials such as carbon fiber has allowed manufacturers to produce more fuel-efficient vehicles and aircraft, reducing their environmental impact.

Lastly, the use of the Internet of Things (IOT) in manufacturing has also proved manufacturing processes. IOT devices can be used to monitor equipment and collect data, allowing manufacturers to identify potential issues before they become major problems. This can reduce downtime and increase overall efficiency.

In conclusion, manufacturing processes have come a long way in recent years, thanks to advancements in automation, robotics, 3D printing, material science, and IoT. These technologies have enabled manufacturers to produce higher quality products more efficiently with reduced environmental impact, and at lower costs. As technology continues to evolve, we can expect even more exciting advancements in manufacturing processes in the future.

4. Dual Cycle – Limited Pressure Cycle

Author Name: Gulsan Kumar Chaudhury

Semester: 3rd

Dual cycle, or limited pressure cycle, is a thermodynamic cycle that combines the Otto cycle and the Diesel cycle. In the dual cycle, combustion occurs partly at constant volume and partly at constant pressure.

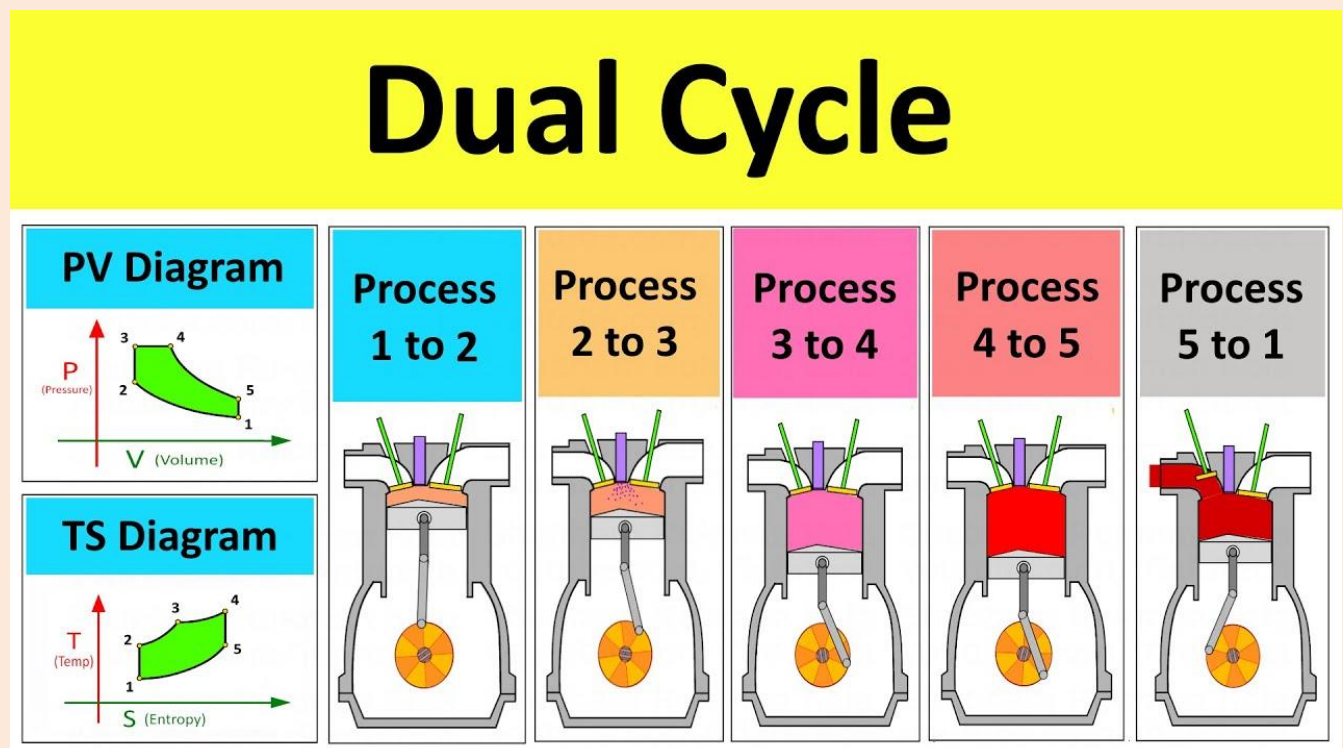
The dual cycle combines the Otto cycle and the Diesel cycle. There is an Otto engine in this picture, which is ignited by a spark plug instead of compression itself.

It can be used to describe internal combustion engines. The pressure-volume diagrams of actual internal combustion engines are not described well by the Otto and Diesel cycles. An air standard cycle that can be made to approximate the pressure variations more closely is the air-standard dual cycle. A more capable approach would be to model the combustion process in both Otto and Diesel engines as a combination of two heat-transfer processes, one isochoric process, and one isobaric process.

Compared to an Otto cycle, which assumes an instantaneous heat addition (isochoric heat addition), heat is added partly at constant volume and partly at constant pressure in a dual cycle. Therefore the advantage is that more time is available for the fuel to combust completely. On the other hand, the use of a dual cycle is slightly more complex. The thermal efficiency lies between Otto and Diesel cycle.

Dual Cycle – Processes

In a dual cycle, the system executing the cycle undergoes a series of five processes: two isentropic (reversible adiabatic) processes alternated with two isochoric processes and one isobaric process:



Isentropic compression (compression stroke) – The gas is compressed adiabatically from state 1 to state 2, as the piston moves from intake valve closing point (1) to top dead center. The surroundings do work on the gas, increasing its internal energy (temperature) and compressing it. On the other hand, the entropy remains unchanged. The changes in volumes and their ratio (V_1 / V_2) are known as the compression ratio. The compression ratio is smaller than the expansion ratio.

Isochoric compression (ignition phase) – In this phase (between state 2 and state 3), there is a constant volume (the piston is at rest) heat transfer to the air from an external source while the piston is at rest at the top dead center. This process is similar to the isochoric process in the Otto cycle. It is intended to represent the ignition of the fuel-air mixture injected into the chamber and the subsequent rapid burning. The pressure rises, and the ratio (P_3 / P_2) is known as the “explosion ratio”.

Isobaric expansion (power stroke) – In this phase (between state 3 and state 4), there is a constant pressure (idealized model) heat transfer to the air from an external source (combustion of the fuel) while the piston is moving toward the V4. During the constant pressure process, energy enters the system as heat Q_{add} , and a part of the work is done by moving pistons.

Isentropic expansion (power stroke) – The gas expands adiabatically from state 4 to state 5 as the piston moves from V_3 to the bottom dead center. The gas works on the surroundings (piston) and loses an amount of internal energy equal to the work that leaves the system. Again the entropy remains unchanged.

Isochoric decompression (exhaust stroke) – In this phase, the cycle completes by a constant-volume process in which heat is rejected from the air while the piston is at the bottom dead center. The working gas pressure drops instantaneously from point 5 to point 1. The exhaust valve opens at point 5. The exhaust stroke is directly after this decompression. As the piston moves from the bottom dead center (point 1) to the top dead center (point 0) with the exhaust valve opened, the gaseous mixture is vented to the atmosphere, and the process starts anew.

During the Dual cycle, the piston works on the gas between states 1 and 2 (isentropic compression). The gas works on the piston between stages 2 and 3 (isobaric heat addition) and stages 2 and 3 (isentropic expansion). The difference between the work done by the gas and the work done on the gas is the network produced by the cycle, and it corresponds to the area enclosed by the cycle curve. The work produced by the cycle times the rate of the cycle (cycles per second) is equal to the power produced by the Diesel engine.

5. Cutting Fluid: Definition, Purpose, Properties, Types, Applications, and Selection

Author Name: Harsh Kumar Burnwal

Semester: 5th



What Are Cutting Fluids?

Cutting fluids are essentially the type of fluids which are generally used while cutting operation takes place. It is primarily applied in machining tasks which can be anything including drilling, milling, turning, cutting etc.

Cutting fluids are used for improving the cutting condition and life of the tool. It is also referred to as Coolant or lubricant because it is used to reduce the heat generated during the metal working operation or in other words to cool the cutting tools.

It mostly comes in liquid form but can be in gaseous form too. Most of the time a cutting fluid is often confused with a coolant (a form of oil), but a cutting fluid performs multiple roles and functions.

Cutting fluids are most commonly used during the metal cutting process. Its main role is to avoid production of heat during the machining process. It keeps a check on the rise in temperature and the damage caused due to heat. Cutting fluids also reduce the friction significantly between two objects.

It is used in the form of liquid which is applied to the chip zone in metal cutting. In simpler words it cools the tool and the work piece. Machining operation generates a lot of heat and thus a cooling fluid is required. Cutting fluid is the best oil available for that purpose.

Common Properties of Cutting Fluid:

Here are the most common properties of cutting fluids. Let's have a look!

- It is known for its High heat absorbing capacity
- It has significantly high flash point
- It is non corrosive to the equipment's which are used such as the main tool and work material
- Cutting fluid is usually harmless to operate and has no negative effect on the bearing

- It has extremely good lubrication properties which is helpful in decreasing the frictional force and to reduce the power consumption.
- Cutting fluids have high specific heat, high heat conductivity, and high film coefficient

Some of the Best Cutting Fluid Applications:

Let's now understand more about its application. Although there are so many applications and purposes of using cutting fluids the four most common applications are:

As a coolant – Cutting fluids are often used as coolant. It is applied to cool down the cutting tool, and cut piece.

As a lubricant – It is also used as a lubricant to lubricate the tools and the machinery so that it facilitates easier movement of the tool while on job and also reduces the cutting force and friction.

As a flushing fluid – It is used to wash off the chips and to get a better surface finish.

Selection of Cutting Fluid:

Selection of cutting fluid plays an important role. It is advisable to select high quality cutting oils so you can derive optimal benefits from it. But the question arises how you ensure that you select the best cutting fluid. Let's find Right selection of Cutting fluid primarily depends on the material to be cut along with the tool used.

It also majorly depends on what type of operation you want it to perform such as drilling, cutting or for something else.

Lastly it also depends upon the degree of the cooling effect required for the operations.

Now based upon these three choices, you have to select the right cutting fluid for you. We bring to you the list of materials along with the kind of cutting fluid you should apply for each material. This will make your job much easier and also let you select the best cutting fluid.

Here are some common types of material and the recommended cutting fluid for optimum efficiency:

- CI, Brass – dry fluid is best
- For copper based material – Turpentine is recommended
- Aluminum – Kerosene is the best choice of cutting fluid
- Steel – We can use any type of cutting fluids
- For high-speed steel and for hard steel or bronze – We should use neat cutting fluids or mineral oils.



Chapter-3

Technical Magazine

Sparkle'2023

Computer Science & Technology

Name of the Editors:

- 1. Mr. Rana Chakraborty (HOD)**
- 2. Mr. Sakya Sarkar (Sr. Lecturer)**

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1. ChatGPT: AI Language Revolution

Author Name: Subarna Ganguly

Semester: 5th

ChatGPT AI platform created as much a storm as the World Cup- it was the pivot of all discussions in the month of December 2022. It won the hot topic for all AI users.

It crossed one million subscriber in just five days after ChatGPT launch on 30th November, 2022, which is one of the records in the world at the moment. Most popular site Twitter took 24 months to reach one million subscribers. Facebook reach one million users in 10 months. Spotify hit one million users 5 months after launch. Through this we can understand very well that the future scope of ChatGPT's business is huge.

OpenAI is one of the companies in world working on AI. The organization was founded in San Francisco in 2015 by Sam Altman, Reid Hoffman, Jessica Livingston, Elon Musk, Ilya Sutskever, Peter Thiel and others. It was a completely a non profitable organization. In 2019 Microsoft invested 10 billion dollars in OpenAI. OpenAI's first successful product was DALL-E2. The new product that OpenAI has currently released is ChatGPT. So far ChatGPT has three versions, Currently running ChatGPT3.5. The OpenAI's market value currently stands at 29 billion due to the success of ChatGPT.

ChatGPT is a natural language processing tool built with AI, ChatGPT is basically a chatbot that can find answer to any question by thinking like a human. Using ChatGPT we can do many work easily, Like writing an email or checking grammatical mistakes or creating presentation etc. Just a student can easily solve math with ChatGPT, a programmer can use it for programming. So Chat GPT's intelligence is much more than a normal human.

Now we may wonder how good this ChatGPT can be. When it was initially unveiled, the interest in it from all over the world was incredible. One of the early co-founders of OpenAI was Elon mask, who was initially asked to explain "ChatGPT was scary good we are not far from dangerously strong AI".

Now we will talk about how ChatGPT works, ChatGPT actually has all the data from 10 to 20 years. And whenever we ask it something, in the background it searches and give us an appropriate answer.

Now many people have built their own income streams using ChatGPT, some have made their own income way by writing articles and some have started web development using ChatGPT.

Now the question come in our mind that in a search engine we can find such a solution. But the difference is here a search engine will give various links for a solution or some kind of websites

will suggest us but the ChatGPT's matter is different, it does not go to any website, it automatically will give us the solution that we want to know.

Now we can think if ChatGPT has any limitations, yes of course ChatGPT still has many limitations. There are many things which if asked may be not possible to answer.

There are two sides to the coin-there is a lot of positive values in ChatGPT but it might boomerang in future. It may spoil creativity manner of a man. It may have very negative impact on the student community. And it encouraging them to be indolent.

So, the question now arises will ChatGPT take your job or not. The answer is yes or the answer is no, if you do a task that it repeatable, that a machine can learn very quickly, then your job is at risk. But one think we have noticed, that in order to run this thing, It is very important to have one thing. That is "Questions". A machine can only give you an answer ,That util now, and I don't think ever, a machine will ask a question. Only we can ask questions. Only you can ask questions. If you have the ability to ask questions, then you will be able to work with any machine and that machine will then become your slave. If you know how to ask questions, the machine will not replace you. It will exist because of you. If we do not fall vices. we might be able to make the world a better place. This platform indeed has come to us as a revolution.

2. Computer Network

Author Name: Pubali Mitra

Semester: 3rd

A computer network is a set of computers sharing resources located on or provided by network nodes. The computers use common communication protocols over digital interconnections to communicate with each other. These interconnections are made up of telecommunication network technologies, based on physically wired, optical, and wireless radio-frequency methods that may be arranged in a variety of network topologies.

The nodes of a computer network can include personal computers, servers, networking hardware, or other specialized or general-purpose hosts. They are identified by network addresses, and may have hostnames. Hostnames serve as memorable labels for the nodes, rarely changed after initial assignment. Network addresses serve for locating and identifying the nodes by communication protocols such as the Internet Protocol.

Computer networks may be classified by many criteria, including the transmission medium used to carry signals, bandwidth, and communications protocols to organize network traffic, the network size, the topology, traffic control mechanism, and organizational intent

Computer networks support many applications and services, such as access to the World Wide Web, digital video, digital audio, shared use of application and storage servers, printers, and fax machines, and use of email and instant messaging applications.

History

Computer networking may be considered a branch of computer science, computer engineering, and telecommunications, since it relies on the theoretical and practical application of the related disciplines. Computer networking was influenced by a wide array of technology developments and historical milestones.

Use

A computer network extends interpersonal communications by electronic means with various technologies, such as email, instant messaging, online chat, voice and video telephone calls, and video conferencing. A network allows sharing of network and computing resources. Users may access and use resources provided by devices on the network, such as printing a document on a shared network printer or use of a shared storage device. A network allows sharing of files, data, and other types of information giving authorized users the ability to access information stored on other computers on the network. Distributed computing uses computing resources across a network to accomplish tasks.

Network packet

Most modern computer networks use protocols based on packet-mode transmission. A network packet is a formatted unit of data carried by a packet-switched network.

Packets consist of two types of data: control information and user data (payload). The control information provides data the network needs to deliver the user data, for example, source and destination network addresses, error detection codes, and sequencing information. Typically, control information is found in packet headers and trailers, with payload data in between.

With packets, the bandwidth of the transmission medium can be better shared among users than if the network were circuit switched. When one user is not sending packets, the link can be filled with packets from other users, and so the cost can be shared, with relatively little interference,

provided the link isn't overused. Often the route a packet needs to take through a network is not immediately available. In that case, the packet is queued and waits until a link is free.

The physical link technologies of packet network typically limit the size of packets to a certain maximum transmission unit (MTU). A longer message may be fragmented before it is transferred and once the packets arrive, they are reassembled to construct the original message.

Network topology

The physical or geographic locations of network nodes and links generally have relatively little effect on a network, but the topology of interconnections of a network can significantly affect its throughput and reliability. With many technologies, such as bus or star networks, a single failure can cause the network to fail entirely. In general, the more interconnections there are, the more robust the network is; but the more expensive it is to install. Therefore, most network diagrams are arranged by their network topology which is the map of logical interconnections of network hosts.

Common layouts are:

- Bus network: all nodes are connected to a common medium along this medium. This was the layout used in the original Ethernet, called 10BASE5 and 10BASE2. This is still a common topology on the data link layer, although modern physical layer variants use point-to-point links instead, forming a star or a tree.
- Star network: all nodes are connected to a special central node. This is the typical layout found in a small switched Ethernet LAN, where each client connects to a central network switch, and logically in a wireless LAN, where each wireless client associates with the central wireless access point.
- Ring network: each node is connected to its left and right neighbor node, such that all nodes are connected and that each node can reach each other node by traversing nodes left- or rightwards. Token ring networks, and the Fiber Distributed Data Interface (FDDI), made use of such a topology.
- Mesh network: each node is connected to an arbitrary number of neighbors in such a way that there is at least one traversal from any node to any other.
- Fully connected network: each node is connected to every other node in the network.
- Tree network: nodes are arranged hierarchically. This is the natural topology for a larger Ethernet network with multiple switches and without redundant meshing.

3. Digital Image Processing

Author Name: Zeenat Farheen

Semester: 5th Sem

Digital Image Processing is a field of study that deals with the manipulation and analysis of digital images. It involves the use of mathematical algorithms and computer software to process and analyze images to extract meaningful information. The primary goal of digital image processing is to enhance images, reduce their size or noise, extract features, and identify patterns and objects.

The rise of digital image processing has revolutionized the way images are captured, stored, and processed. The images captured using digital cameras or smartphones are stored in digital format, which makes them easier to manipulate and process. With digital image processing, it is possible to manipulate images in a way that was not possible with traditional photography. The most common applications of digital image processing include medical imaging, satellite imagery, industrial inspection, and security and surveillance.

One of the primary techniques used in digital image processing is image enhancement. Image enhancement is the process of improving the quality of an image by adjusting its brightness, contrast, sharpness, and color balance. This is done to make the image more visually appealing and to improve its readability. Image enhancement can also be used to correct defects in an image caused by camera malfunction, lighting conditions, or other factors.

Another important aspect of digital image processing is image compression. Image compression is the process of reducing the size of an image without affecting its quality. This is important because digital images can be quite large in size, which can make it difficult to store and transmit them. Image compression algorithms work by removing redundant or irrelevant information from the image, which results in a smaller file size. There are several different types of image compression algorithms, including lossless and lossy compression. Lossless compression algorithms maintain the original quality of the image, while lossy compression algorithms reduce the quality of the image to achieve a smaller file size.

Another important aspect of digital image processing is image segmentation. Image segmentation is the process of dividing an image into multiple segments, each of which corresponds to a different object or region in the image. This is done to make it easier to identify and analyze objects in the image. Image segmentation is used in a variety of applications, including object recognition, image classification, and medical imaging.

Another key aspect of digital image processing is feature extraction. Feature extraction is the process of identifying and extracting meaningful features from an image. Features can include edges, corners, and lines, as well as other characteristics of the image such as color and texture. Feature extraction is used in a variety of applications, including object recognition, image classification, and pattern recognition.

Digital image processing has also had a significant impact on the field of medical imaging. Medical imaging refers to the use of various imaging technologies to visualize the internal structures of the human body. Medical imaging technologies include X-rays, CT scans, MRI, and PET scans. Digital image processing is

used to enhance the images produced by these technologies, making it easier for physicians to diagnose and treat medical conditions.

In conclusion, digital image processing has revolutionized the way images are captured, processed, and analyzed. The use of mathematical algorithms and computer software has made it possible to manipulate images in ways that were not possible with traditional photography. Digital image processing has a wide range of applications, including medical imaging, satellite imagery, industrial inspection, and security and surveillance. With its ability to enhance images, extract features, and identify patterns and objects, digital image processing has become an essential tool in many areas of research and industry.

4. Emerging trends in Science Engineering and Technology

Author Name: Nisha Kumari

Semester: 5th Sem

Science and engineering has always played an essential role in the development of India. Since then science and engineering has become an important part in our day to day life. We get up in the morning from the ringing of our mobile alarm till going to bed after switching the lights of are all wonders of science. It is very difficult to imagine our lives without the use of technology. All these luxuries which we are able to afford are because of years of engineering and the engineers who make it possible. Everyday new technologies are coming up which are making human life more comfortable. This we live in an era of science and technology.

Especially science and technology have introduced us to the establishment of modern civilization. This development contributes greatly to almost every aspect of our life.

Now let us look into some of the emerging trends in technology:-

- 1) Robotic process automation- This technology is automating jobs. RPA is the use of software to automate business processes and to minimize human intervention to avoid errors.
- 2) Virtual Reality and Augmented Reality- With the advancement of virtual reality we can meet new people and experience them as they are just sitting next to us. Thanks to the concept of metaverse these things are coming to reality. It isn't far away when we no need to go to school to study or go to office to do our jobs or have meetings. People can experience all these just by staying home. All people need is a device and internet connection.
- 3) Cyber Security- With the increase in technology comes with the cost of people getting exploited by these technology. So a cyber security is not a old topic but is a very emerging topic and trend that need to get advance over time so that all the technology and device can be protected and cyber crime can be controlled.

It is not only all these but there are many more trends that will shape the future of computing, tech support, automation, factory working line and peoples life to.

Many technological things are coming with built in WiFi technology so that they can be connected to the internet to unlock a device's full potential. You can open house lock for your relatives if you are not available to do so just by clicking on your mobile. This is due to the new trend in the field of technology known as Internet-of-Things(IOT). With this technology we can start our home AC from our office before arriving to keep the room cool.

New trend such as blockchain which was around from a long time has seen massive growth. Governments have also seen the use and advantage of this trend and is working to use blockchain in their upcoming projects.

Space travel is becoming much more common as new technology also supports space travel and has become much safer. Reusable rockets are also made to make the environment more sustainable and so that we don't need to manufacture a product over and over again.

Science has played a major role in protecting our environment. Each day we are become less dependent on coal and more reliable in renewable energy resources such as solar panels and wind turbines. With the advancement of science all these are possible and people will adopt these to meet their energy demands. These new renewable energy source has no byproducts and are not harmful for nature. Instead its a wonder what science can do to protect the nature and also fulfill human greed.

The rise in the trend has opened new possibilities of learning and development. In this fast paced world where technology is rapidly changing it becomes very hard to cope up with everything and get adjust to it. Lets look at some downsides of rapidly rising technology trend that can effect human sustainability.

Lots of low level jobs are lost everyday due to the automation such as job of chat support, support engineer, factory worker and many more. Thus causing unemployment and poverty. This emerging trends comes with a downside and people must be ready to avoid unemployment and job loss.

5. Essay on Technology

Author Name: Shrasta Laha

Semester: 3rd Sem

Technology, in general, refers to all the tools, machines, or devices used in our day to day life. It is the result of the advancement of science. Technology in a broader sense can be understood as the use of scientific knowledge and discoveries to accomplish our tasks easily and quickly.

History of Technology

The word technology comprises two Greek words 'techne' which means art and craft and 'logos' which means word or speech. The usage of this term dates back to the 17th century. Technology has evolved much more since the industrial revolution of the 1760s. The revolution became the result of many prominent inventions like a steam engine, typewriters, photographic machines, telegraph communications, etc. Moreover, many scientists like Pascal, Charles Babbage, Newton gave their important contributions to the field of technology. The technological advancement was much more during the era of World War I and World War II. These wars caused the rise of military weapons, fighting vehicles, grenades, bombs, etc. In the past years, technology has evolved much more and completely changed the lifestyle of human beings.

Ancient and Modern Technologies

Since the stone age, human beings have been crafting different types of tools for their comfort. In ancient times, humans used natural tools like sticks and stones for hunting and protecting themselves. After humans start depending on agriculture and animal husbandry, technology innovations increased remarkably. They invented various tools and weapons to aid their tasks. The fire was also an important discovery in prehistoric times to power technology. After the evolvment of industries, various industrial machines were invented to promote manufacturing. People started to feel the need for a transportation medium which ultimately led to the inventions of various vehicles. In this way, technology has evolved from prehistoric to the modern age. Nowadays, we have advanced much more in terms of technology. The robots are being used for doing various household as well as industrial tasks. Mobile phones and the internet have made this world a global village. The evolvment of various communication techs and mass media has changed the way we communicate with each other. Artificial Intelligence (AI) is used in different fields like healthcare, security, warfare, and so on.

Advantages of Technology

Technology has become a vital part of our life. Without the use of technology, we can't imagine a simple and comfortable life. All things we use like mobile phones, television, washing machine, bicycle are technology. Internet is probably the most famous means to spread information. Using

the internet, one can easily get the news, views, updates, and insights of the world. People can communicate with each other through voice calls and video calls. The use of technologies has revolutionized the way we communicate with each other. Moreover, using the internet one can easily work from home, do their official works, do online shopping, and much more activities. Using communication gadgets like mobile phones, telephones people feel connected with each other. Technology is important for students too.

The use of technologies has enhanced the teaching-learning activities. Students actively take part in the visual learning process through animations using various software and programs. They can surf various learning websites, collect data and information related to their course content, and can also take different online tutorials. Moreover, technology also saves time for people and makes them more productive. The transportation process is made easy with the use of various vehicles. Large companies use computers and other different gadgets to accomplish their work. Industrial tasks are automated by the use of machines and robots that have resulted in large production in a shorter time. Whether be it the field of industry, banking, education, transport, communication, or security, it is the technology that has made the works easier and smoother.

Disadvantages of Technology

Although technology has made human life easier, it also has a lot of bad effects on our life. Modern gadgets waste time of people. Gadgets like mobile phones, television, video games, music players, etc. kill the precious time of the people. Instead of doing productive tasks, many people involve themselves in such unimportant activities. Thus, it has caused a distraction from the study as well as work. This diverts people from their ambitions and goals. It reduces the creativity of people. Many young minds are addicted to technology. Overuse of technology leads to isolation from society, family members and may even cause anxiety and depression. It can also harm physical and mental health.

Technologies have effects on the environment too. Different vehicles which run with fuels cause air pollution. Industrial wastes and chemicals result in the pollution of water and land. Heavy vehicles, airplanes, loud music players cause sound pollution. Moreover, excessive use of technology in every sector has lowered the value of human workers. Technology can even cause threats and dangers to people, society, and nations. Military weapons like guns, bombs, grenades, land mines are used in the war among groups or nations which leads to the mass death of the people. Thus, even technology is a gift to everyone without which life cannot be imagined but we cannot deny the severe impact of technologies on our life and environment.

6. Internet of Things

Author Name: Mrinal Tudu

Semester: 3rd Sem

Introduction

Technology is playing a major role in our lives. The advent of different types of technologies has changed the way of our living and working. The discovery of computers and the internet has brought a revolutionary change in the world. People at present mostly depend upon the internet and computer to perform their maximum tasks. Not only it has changed our lifestyle but also made it comfortable. Internet of things is also an aspect of the internet. We will discuss this technology, its history, application, and future scope in the essay provided below.

IoT refers to the collection of different types of daily life appliances and gadgets used in different sectors that are broadening the aspect of the internet. The connectivity with the internet enables these devices to share and receive data with different objects. Internet of things simply means the network of devices that are able to share and receive data and information with other devices via using the internet.

The things or objects in the Internet of Things above are well equipped with sensors, software, and machine learning techniques. The use of such objects reduces human interference in doing any of the work. The advent of IoT has totally changed the life of human beings by reducing their workload and time. The advancing technology day by day is giving rise to different smart objects thereby improving the standard of living of human beings.

IoT Architecture

The objects in Internet of Things have a definite constitution of technologies that enables them to work efficiently by using internet connection. These devices are architecture that is a combination of several technologies. The technologies that are embedded in IoT are enlisted below:

Different Types of Sensors- IoT devices have sensors embedded in them so that these devices can sense whatever is happening in the environment. It is working in the same way as the human sense organs are working. The connection of sensors with the internet helps it to collect information from the surroundings.

Internet Connection- An internet connection is a must to enable the sensors in the devices to connect it with other devices so that the sending and receiving of data becomes convenient.

Several Computing Devices- These devices help in making the process of data collection, analyzing, and sending more easily.

Machine Learning and Analytics Devices- The use of machine learning and advanced analytics by the Internet of things make this process more efficient. It helps the devices to collect maximum data in very less time.

Artificial Intelligence- Artificial intelligence and machine learning help the devices to develop connectivity with other devices in the IoT network in a smarter way. In another way, we can state

that it smoothen the process and helps in reducing human interferences in performing any kind of task. Example: Alexa, Siri, etc.

Need of IoT

The developments of a range of technologies have enhanced the lifestyle of human beings. Isn't it true? Digitalization is taking place in India and the world at a very fast pace. Thus in order to be in the pace with the digital world, the network of smart devices is very essential. It is a technology that helps in establishing a good interaction between the different devices among themselves and also with human beings.

Moreover, the emergence of devices embedded with sensors and advanced technologies reduces the workload of human beings. It helps in finishing different tasks in less time along with developing coordination with the activities taking place in the surroundings. The development of the network of these smart devices is not only useful in household works but also aid in commercial sector tasks. Thus, IoT in the 21st century has become an essential requirement in different sectors all around the world.

Advantages and Disadvantages of IoT

IoT which stands for Internet of Things helps in enabling the smart devices to interact with each other by sharing the data. There are several benefits with the emergence of this technology but there are also some drawbacks associated with it. Several advantages and disadvantages of IoT have been enlisted below.

Advantages

The IoT devices help in establishing interaction between the devices connected with each other through the internet.

The sensor embedded in the smart devices makes it capable of collecting and accessing different information at any time.

The collected data can be analyzed and further brought into action or shared with other devices in very less time. This reduces the effort and time taken in doing the same work by people manually.

Disadvantages

There are many devices connected with each other in IoT and thus sharing of different information takes place. The probability of hacking some important information increases in such processes.

The enterprises concerned with different businesses can acquire information from several devices connected to the IoT networks. It is difficult for them to collect and manage data from a large number of IoT devices.

Every smart device does not have compatibility for connecting with other devices as there is no international standard of IoT.

IoT Doing Wonders

The invention of devices embedded with sensors and smart software has widened their application in different sectors. These devices not only form an integral part of household works but also play a major in different sectors like industrial, manufacturing, healthcare, agriculture, etc.

IoT in Manufacturing Sector- The manufacturing and industrial sector has benefitted a lot as the IoT devices help in monitoring the working of all the machines. The machines are connected with each other so that they can develop good communication and can be controlled easily. The quality of the products can also be checked at regular intervals by using these smart devices. Therefore, it can be stated that the development of such smart technologies is helping in increasing the performance of machines, fostering production, and boosting up the customer experience.

IoT in Healthcare- IoT devices is of great importance in the healthcare sector. It gives rise to connected devices like wearable's that help the doctors to monitor different activities of the patients. These devices can also be used by people to monitor their health regularly. Thus, it can be stated that the use of these advanced technologies has improved the diagnosis and treatment procedure by making it more precise.

IoT in Transportation- The introduction of GPS and sensors in the devices has reduced the difficulty of locating the exact locations. This reduces the effort and time wastage of transportation companies in searching the locations. They can deliver the products more efficiently with any kind of delay. Thus, IoT devices help in cutting down the cost as the monitoring, tracking of the vehicles and locations can be managed easily by using smart devices. Moreover, it also enhances the customer experience.

IoT in Household works- The use of smart appliances in the home enables us to carry our household work with great ease. The working of these devices can also be controlled remotely by using computers and smart phones.

IoT in Agriculture- The use of IoT in agriculture is very benefitting for the growth and production of different crops. The smart devices help in collecting the data from the surroundings and further after analyzing the same the action can be taken. The soil parameters can be easily detected by using devices having inbuilt sensors. These devices can easily access the condition and suggest the type of crop that can be grown easily with good yield in the future.

There are several sectors that are benefitted with the advent of the network of smart devices. We can notice these devices everywhere around us. They now have become an integral part of our life. The presence of these devices has made our lives more comfortable.

Future of IoT

There are different types of new innovations taking place in different regions of the world every now and then. Internet of Things (IoT) is also one such invention. It has gained surplus attention of the world and is now being used in different sectors.

The need of the internet is very essential nowadays. Internet, sensors, and advanced technologies have made normal devices turn into smart devices. The integration of these smart devices is referred to as the Internet of Things. There are more than 4 billion smart devices installed in the

world at present. The numbers will increase to double in the coming years. It is because the use of the internet in the coming years will more profuse. The large network of smart devices will help in getting vast data in a spark of seconds. This in turn will foster the businesses; increase the product variety, efficiency in the delivery of products, etc. The Internet of things has a good potential in the future but a few challenges need to be addressed to make it a successful technology in the future.

Conclusion

The Internet of things has widened the aspect of internet. This has become the most discussed topic at present. These smart devices influence our life in our travel, shopping, lifestyle, health, daily works, etc. The Internet if things are not only restricted to the household objects but they have their wide applications in different sectors. In this way Internet of Things is having a positive impact on the society.

Yet there are some challenges but efficient working in this direction will reduce the drawbacks in the coming future and make it a technology with great potential. This long essay contains the elaborated details about the Internet of Things. I think that this essay in simple words would have been helpful to all the students and readers in knowing about this most discussed concept of present. I hope that you all will love reading this essay.

7. Quantum Computing

Author Name: Nilam Kumari

Semester: 5th Sem

In recent years, there has been a lot of buzz around quantum computing and its potential to revolutionize various industries. Quantum computing, which relies on the principles of quantum mechanics, has the ability to perform certain types of calculations exponentially faster than classical computers. This makes it a promising technology for solving complex problems in areas such as cryptography, drug discovery, and financial modeling.

In October 2019, Google made a major breakthrough in quantum computing when it announced that its quantum computer had achieved "quantum supremacy" by solving a problem that would take a classical computer thousands of years to solve in just 200 seconds. This was a significant milestone for the field of quantum computing and demonstrated the potential power of this technology.

Since then, several other tech giants, including IBM, Microsoft, and Amazon, have been investing heavily in quantum computing research and development. In January 2022, IBM announced that it had achieved a new milestone in quantum computing by demonstrating a quantum computer with 127 qubits, the most powerful quantum computer to date.

However, there are still many challenges to overcome before quantum computing becomes a practical technology that can be widely used. One of the biggest challenges is the issue of quantum error correction, which is necessary to ensure the accuracy and reliability of quantum calculations. Despite these challenges, the potential of quantum computing is driving significant investment and research in the field, and it is likely that we will see more breakthroughs and progress in the coming years.



Chapter-4

Technical Magazine

Sparkle'2023

Mining Engineering Department

Name of the Editors:

- 1. Dr. Sankha Sarkhel (HOD)**
- 2. Mr. Pankaj Kumar (Lecturer)**

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1. THE MODERN MINE

Author Name: **Pankaj Kumar, Lecturer**

Modern mining increasingly uses automated techniques for safe and economical mining.

We are using automated and continuous rock cutting vehicles to safely extract the targeted ore deep underground without the need for explosive blasting, thereby creating far greater rock stability and far less variance in the quality of the ore we extract. Such safety and productivity innovations make it possible for us to mine lower grade ores and complex mineralogy, creating a safer environment, lower operating costs while enhancing the value of the mineral resource in the ground.

Re-imagining how the underground mine operates

Our riskiest operations from a safety perspective today are our underground platinum mines. The technical demands of underground hard rock mining operations are higher than for **open cut**, which is why we are collaborating with key mining machinery and technology manufacturers (OEMs) on three automated and continuous mining vehicles designed to create far greater rock stability and less variance in the quality of the ore we extract.

We have created the **Rapid Mine Development System (RMDS)** together with Atlas Copco, designed to quickly, cost efficiently and safely excavate low-profile tunnels in hard rock. The RMDS excavates a rectangular-shaped tunnel, important for roof stability purposes in platinum mines, as well as providing the flat floor needed by mine vehicles. As well as removing people from areas of most danger underground, the RMDS causes less damage to the overhead walls, thereby reducing the risk of collapse and enables greater ore excavation time as there is no time lost for explosive blasting.



Testing new technology at our Twickenham platinum mine in South Africa

One of the crucial components of moving from batch to continuous hard rock mining is the mechanization of the transport of the hard rock cuttings from the back end of the RMDS to the mine's fixed conveyor system. Here are some mining technologies currently in development at our mines:

1. Continuous haulage systems

We are also collaborating with SANDVIK on a **continuous haulage system (CHS)**. This is a remote controlled device, that connects the RMDS to the mine's fixed conveyors. CHS is now being tested underground at Twickenham mine.

2. MM 220 Reef Miners

Also in development with SANDVIK is another remotely operated rig, the **MN 220 Reef Miner**. This incorporates cutting and roof bolting and is designed for mining narrow mineral reefs in hard rock. It is up

to three times faster than conventional drill & blast methods and, of course, also removes our people from harm's way. After successful proof of concept trials in South Africa in 2013, it is now being optimized specifically for platinum mining.

3. Slot Borers

Also under development with Atlas Copco another reef mining innovation is the **Slot Borer**. Based on proven raise-boring technology but designed to drill narrow vein hard rock ore body of just 1m-1.5m. It is in proof-of concept testing in South Africa.

Taken together, the safety and productivity gains from a continuous mining process in hard rock are significant: yielding improvements in tunnel advance rates and reduction in operating costs, while removing people from harm.

Robotics will make underground mining safer for all

Notably, it took the coal industry two decades to move from conventional mining to mechanization and partial automation, so the learning from these underground cutting and rapid mine development projects, applicable to underground diamond as well as platinum mining, are exciting for Anglo American; they are also vital to the future of underground mining in an era of deeper mines, increasing costs and falling productivity.

Further away, we are testing the latest robotics technology to send low-profile autonomous vehicles, instead of our people, into deep tunnels. The advantages of a fleet (or "swarm") of low cost, modular mining robots are two-fold: because they go directly into the valuable ore body, without touching the overburden, they significantly reduce the safety risks of underground mining; they also deliver precision mining on a daily basis.

Compared to conventional mining, a "swarm" robotics system breaks the paradigm of scale. Innovation in mining has traditionally meant scaling up – bigger trucks, bigger shovels - to increase capacity. With robotics, the smaller the better: lightweight and modular, robots can perform multiple tasks, with precision, *in any terrain*.

We are also rounding off work on cryogenic SQUID – an exploration technology that can detect and map a range of ore deposits. Specifically, we are modifying its carriage so it can be adapted for multiple aircraft attachments and drone flights. SQUID – a super conducting quantum interference device – is particularly useful for finding buried metallic deposits that are masked by other conducting metals.

Together with advances in data science, automated and remote systems will lead inevitably to a simpler, faster – and standardized – operation; an outcome that will move mining closer to reducing and better managing the huge variability that characterizes the industry today, while generating safety and productivity gains.

Such safety and productivity innovations make it possible for us to create a safer environment, while mining lower grade ores and complex mineralogy, at lower cost.

2. GOLD MINING TECHNIQUES

Author Name: Akalesh Kumar, Lecturer



The Cradle

- The cradle was one of the most successful mining methods of the gold rush period. The cradle looked like two boxes, one on top of the other. Inside the boxes were slats to regulate the water flow. On top was a sieve to remove big rocks and on the bottom of the cradle were slats to catch the gold. Water was poured through the cradle to make this effect. The rubbish came out the end the cradle was rocked to swill the water and the dirt.

Teamwork

- Many miners worked in teams to maximize the amount of gold they found. These teammates were usually business partners or friends. They split the license fee amongst themselves and shared all the gold they found. These teams from two to up to 10 would mine shafts and would rely on each other to take care of sick or wounded miners.

Shaft Mining

- The shaft mine was a small mine dug vertically into the ground by teams of miners. These mines were shallow as the miners didn't have the time or the equipment or the money to dig the deep holes that the big companies mined. It would not have been worth the miners while digging so deep to reach the extensive quartz veins below the surface. Another reason they were small was because they mined meticulously to extract any gold in the mine and as soon as the flow of gold wavered, they would leave.

Reef Mining

- The reef mine was introduced after the initial gold rush when alluvial gold became harder to find. Rich men funded big machines to dig down to the extensive gold-bearing quartz veins and paid the miners wages. This was very attractive for the miners because it was becoming too expensive to continue mining shafts and that they would get paid to mine gold. Some miner's said that it took the splendor out of gold mining because all the gold found went to the boss.

The Stamper

- The stamper was a big machine that could extract ore from rocks by crushing it. Both the scampered the engine was expensive and could only are purchased by very rich people. The stamper was a series of heavy weights attached to cam shafts. The stamper was powered by engines or they were powered by the water wheel. The cam shafts were

pulled up and then dropped on the ore crushing into a fine powder. The powder was then washed with Mercury which was then evaporated leaving the gold behind. The stamper was usually used in conjunction with the reef mine because of its efficiency.

Deep Sinking

- Many rich men funded mines very deep down because of the gold-bearing quartz veins. These were different to the reef mines because reef mines didn't go down as far as the deep sink mines. Deep sink mines were very expensive because very often they would have to drill through a big layer of rock without finding any gold. Because of this, the employer of the miners would be in debt. There were many upsides to deep sink mining, however. Deep down were numerous large veins in which there was much more gold than reef mines. There were many clues to finding gold such as galena, lead sulphide, mundie and sulphur.

The Gold Factory

- The gold factory was a gold processing plant that would process gold ore with a series of stampers. The mining companies would pay the gold factory money for crushing the ore and the factory would then give back the crushed gold. If you owned one of these companies, it would be like license to print money as these companies made lots of business.

The Water Wheel

- The water wheel was not actually a mining technique; it was a power source for some of the mining techniques. It could provide the power for the gold factory or it could provide light for the mines. The water wheel was a big apparatus that had numerous buckets. Because the water wheel needed flowing water to function, the water wheel was positioned over a strong river. As the buckets collected water, the weight tuned cogs in turn turning turbines making electricity.
-

3. ROCK BLASTING FOR MINING

Author Name: **Bittu Kumar Sinha,**
Technical Assistant

Objectives:

You are all aware that Mining is a major economic sector of any country.

Mining is a geotechnical industry. Geologist explores the economic mineral deposits for mining. A lot of methods are adopted to exploit the valuable economic mineral resources through open cast mining or underground mining methods.

In all these methods, there is a need to dislodge the ore or mineral deposit from the main body of the rocks. Dislodging requires heavy energy application and machineries. To simplify the work, rock blasting is the easiest way.



In mining operations, blasting has become a routine work. With proper understanding of the rocks and blasting methods, the mining work can be done effectively. The basic objectives of this report is to highlight the principles and practices adopted in rock blasting operations for mining sectors.



The aspects concentrated in this report are:

a) Purpose and scope of blasting

- b) Steps involved in blasting
- c) Blast design and patterns
- d) Methods of blasting
- e) Controlling factors of Blasting.

1.0 Introduction:

Most of the economic mineral deposits occur in association with massive hard rocks. These rock masses should be fragmented to obtain the valuables and separate the materials for further processing. Breaking a rock mass involves energy. This can be achieved by drilling and blasting. Hence drilling and blasting are considered to be the first phase of the production cycle in most of the mining operations. Today technology has shown much advancement in several activities of mining.

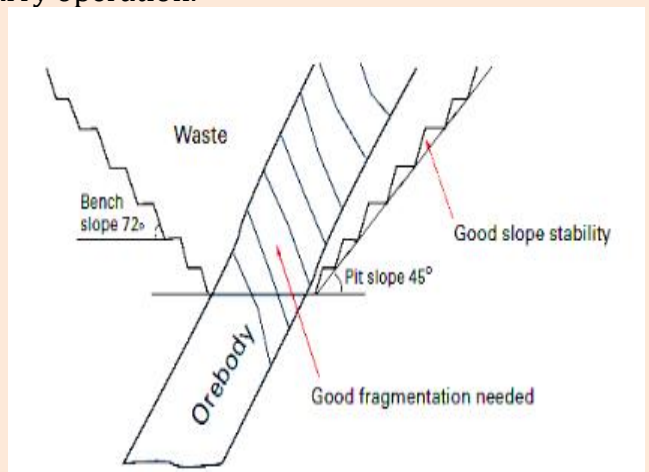
Inspite of that, there is no alternative to blasting or drilling. Quite a lot of improvements have been shown by experts in controlled blasting operations which are more beneficial not only on production point of view, but also on the safety point of view of mine workers. Let us see the details of blasting methods adopted in mining operations.

This image shows a large scale open cast mine.



Large scale mining in hard rock zones is difficult without the application of drilling and blasting operations. This is an aerial view of a mine.

This illustration shows the schematic view of a quarry operation.



This diagram shows the extension of an ore body to be mined after removing the over-burden/waste lying both sides of it. The bench slope is about 45 to 72 degrees.

Systematic blasting is necessary to mine this ore body.

What is blasting?

Blasting is the process of breaking of bulk rock masses into loose forms, using explosive compounds. Here, the primary role is played by the explosives.

The explosives are the substances or devices used in blasting. The explosives are used to produce a volume of rapidly expanding gas that exerts sudden pressure on its surroundings and break the mass into pieces.

There are three common types of explosives used for blasting as chemical, mechanical, and nuclear explosives.

About 100 years ago, the Chinese invented explosives. The first chemical explosive was gunpowder.

Germans manufactured gunpowder in the early 1300s.

A detonator is a device used to trigger this explosive device. Detonators can be chemically, mechanically, or electrically initiated.

Different explosives require different amounts of energy to detonate. Detonation is a necessity for the explosive to get triggered for blasting.

Purpose and scope of blasting:

Blasting is employed for breaking the massive rocks in quarries, open pits, surface and underground mining works.

Sometimes, blasting is also carried out for removing the overburden from the surface of the earth for construction purposes.

An optimum blast is associated with the most efficient use of blasting energy in the rock-breaking process.

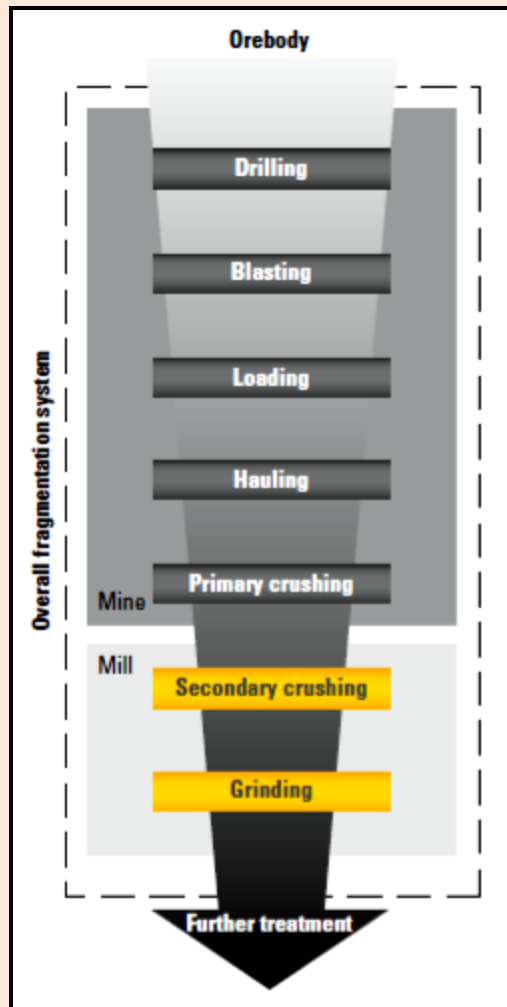
The mine blasting expenditure should also be very less.

The process should not only reduce the blasting cost but also reduce the consumption of explosives, and less wastage of explosive energy in blasting.

During any mining-related blasting, there should be less throw of materials, and there should not be much blast-related vibration.

All these should provide greater levels of safety and stability to the nearby structures and also for all the people working around the mines.

Blasting- An essential part of the mining cycle:



This diagram illustrates the overall organizational structure of a mine cycle. Once the ore body is investigated through detailed surveys, the next steps include drilling and blasting, followed by loading, hauling, primary crushing and other ore-dressing operations. Blasting helps in not only in rock breaking, but also in primary crushing.

So, Blasting is an essential aspect in the mining cycle.

Now, blasting has become a technology by itself.

Many Mega engineering projects need some kind of blasting of basement rocks.

The blasting technology is the process of fracturing the material by the use of a calculated amount of explosive so that a predetermined volume of material is broken down into pieces.

Everything can be visualized by proper calculations and execution, with reference to time and space.

4. ADVANCED DRILLING AND BLASTING SYSTEM

Author Name: **Prince Raj**

Semester: **5th**

Fragmentation monitoring technology

Orica launched a fragmentation monitoring technology that combines real-time oversize detection alerts and accurate particle size distribution of fragmentation for all haul truck models and sizes.

According to Orica, FRAGTrack Gantry uses advanced machine-vision and machine-learning technologies to enable autonomous triggering and processing – without interfering with hauling operations.

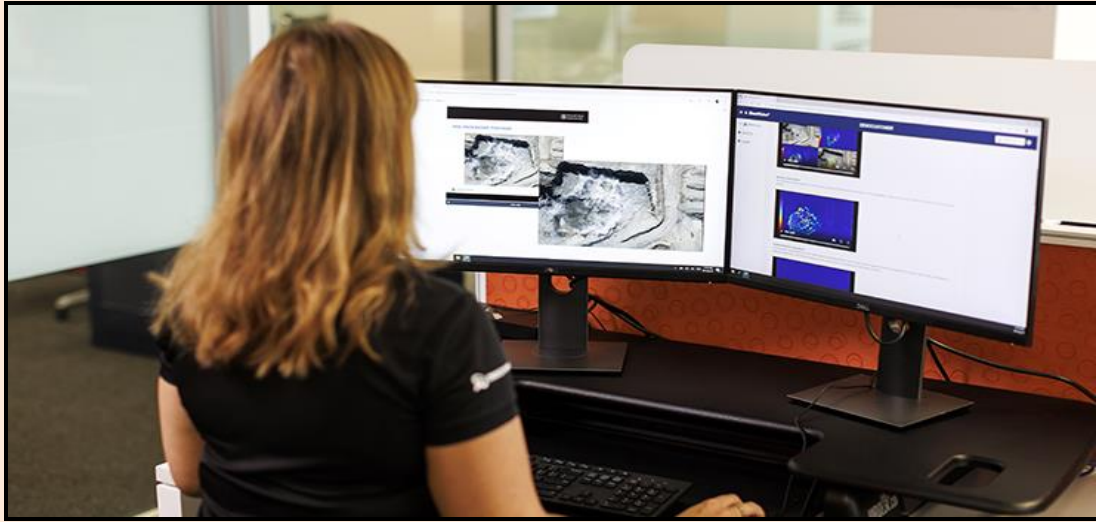
FRAGTrack Gantry leverages real-time oversize detection through AI, Orica says. The machine-learning capability is applied to real-time detection that's accomplished within seconds. Alerts are syndicated via fleet management systems, email or SMS for the rerouting of trucks. Operators can predetermine customizable oversize limits, enabling a reduction in crusher blockage and damage frequency due to oversize material.

“The full adoption of AI technology into our architecture, coupled with our strategic partnership with Microsoft, allows us to expedite the delivery of capabilities that were not previously possible,” says Raj Mathiravedu, vice president of digital solutions at Orica. “FRAGTrack Gantry is another example of how we are leveraging AI to help deliver intelligence and value to our customers.”

Orica says the fragmentation information from FRAGTrack Gantry enables customers to optimize their drill and blast operations for downstream processes without impacting the haul circuit operation. The addition of a Gantry option complements the suite of FRAGTrack measurement systems currently available for shovel-, crusher- and conveyor-mounted configurations.



Blasting analytics



Ground Probe, a member of the Orica Group, also unveiled an innovation it characterizes as a “world first” in blasting analytics.

Blast Vision is a solution delivering actionable blast performance insights so optimal safety and productivity can be achieved. According to Ground Probe, the data Blast Vision collects aids in the detection of potential misfires and out-of-sequence firing, as well as in identifying and tracking fly rock.

Intra-blast monitoring adds wall control insights, the company adds, including the monitoring and mapping of instantaneous blast damage to slopes. Monitoring also identifies movement on significant structures.

“Through talking to mine site engineers responsible for blasting on the ground, we identified that many sites were still quite simple and sometimes using unsafe methods for blast analysis,” says David Noon, CEO of Ground Probe. “From this, the idea of using drone footage and automated algorithms to quickly identify key areas of interest was born.”

As Ground Probe describes, Blast Vision takes custom, high-speed drone footage of a blast as it happens. Using algorithms and modern AI frameworks, Blast Vision converts the footage into analytics data.

Data is then analyzed remotely within a custom software platform, and insights are quickly reported back to sites. From there, Ground Probe says mine personnel can optimize blasting and monitor its impacts.

“Blast Vision provides an increased level of safety, efficiency, accuracy and productivity through our software algorithm automatically identifying key areas and issues,” says Fernando Carrea, vice president at Ground Probe. “Data is also able to be captured before, during and after a blast, and [it] covers the blast area in its entirety.”

Ground Probe says Blast Vision has been tested, trialed or demonstrated at more than 60 mine sites around the world.

Electronic initiation system



BME recently achieved the first blast outside of South Africa with its new Axxis Silver electronic initiation system. Photo: BME

BME, meanwhile, continues to expand its use of the new Axxis Silver electronic initiation system. The Axxis Silver system is a slimmed-down version of the company's Axxis Titanium product, employing a dual basis of safety with a dual-voltage and dual-capacitor configuration. BME says the design reduces the risk of uncommanded firings.

The company's detonators now contain a Swiss-designed application-specific integrated circuit chip, giving the system more internal safety gates against stray current and lightning.

Axxis Silver allows up to 1,800 holes to be detonated in a single blast following an initiation from two blast boxes that are linked. The company says mines are asking for larger blasts to reduce downtime from pit stoppages during blasting.

Also, BME says Axxis Silver performs in all weather conditions – including extreme cold, snow and ice.

"We have had Axxis successfully tested in the U.S. for operating in temperatures below minus 40 degrees in anticipation of growing business opportunities in the U.S. and Canada," says Hennie du Preez, BME's Axxis support manager.

Automatic bit changer



Epiroc says the automatic bit changer option is designed to change rotary tricone bits significantly faster than manual exchanges, eliminating human interaction with the drill string for a safer, more efficient way to operate a drill fleet. Photo: Epiroc

In drilling, [Epiroc](#) introduced an automatic bit changer for hands-free bit changes on the Pit Viper 270 and Pit Viper 290 series drill rigs used in rotary drilling.

The automatic bit changer option is designed to change rotary tricone bits significantly faster than manual exchanges, Epiroc says, eliminating human interaction with drill string for safer, more efficient operation.

According to Epiroc, operators can do bit changes with a single touch of a button and stay informed on their screen. Operators can make or break joints, select drill bits and add or remove them. Bit changes can be done either from a control room or from the cab.

“The early collaboration with customers and cross-functional teams resulted in an auto bit changer that is repeatable, keeps the operator out of the line of fire and improves machine uptime,” says Matthew Fosler, senior design engineer of Epiroc’s surface division.

A carousel design allows up to four bits to be changed faster and safer than a single manual exchange, Epiroc adds. The removable bit carousel can store rotary tricone bits in varying sizes and cutting structure.

The automatic bit changer is available for new drills and retrofit of drills already in the field, the company adds.

“Through its development and trial, the automatic bit changer has proven to be the safest and most efficient way to change bits that is currently available,” says Carla Chaname, product manager of automation for Epiroc’s surface division.

5. HISTORY OF COAL MINING IN INDIA

Author Name: **Prasant Kumar Prasad**

Semester: **5th**

India has a long history of commercial coal mining covering nearly 220 years starting from 1774 by M/s Sumner and Heatly of East India Company in the Raniganj Coalfield along the Western bank of river Damodar. However, for about a century the growth of Indian coal mining remained sluggish for want of demand but the introduction of steam locomotives in 1853 gave a fillip to it. Within a short span, production rose to an annual average of 1 million tonne (mt) and India could produce 6.12 mts. per year by 1900 and 18 mts per year by 1920. The production got a sudden boost from the First World War but went through a slump in the early thirties. The production reached a level of 29 mts. by 1942 and 30 mts. by 1946.

With the advent of Independence, the country embarked upon the 5-year development plans. At the beginning of the 1st Plan, annual production went upto 33 mts. During the 1st Plan period itself, the need for increasing coal production efficiently by systematic and scientific development of the coal industry was being felt. Setting up of the National Coal Development Corporation (NCDC), a Government of India Undertaking in 1956 with the collieries owned by the railways as its nucleus was the first major step towards planned development of Indian Coal Industry. Along with the Singareni Collieries Company Ltd. (SCCL) which was already in operation since 1945 and which became a Government company under the control of Government of Andhra Pradesh in 1956, India thus had two Government coal companies in the fifties. SCCL is now a joint undertaking of Government of Andhra Pradesh and Government of India sharing its equity in 51:49 ratio.

NATIONALISATION OF COAL MINES

Right from its genesis, the commercial coal mining in modern times in India has been dictated by the needs of the domestic consumption. On account of the growing needs of the steel industry, a thrust had to be given on systematic exploitation of coking coal reserves in Jharia Coalfield. Adequate capital investment to meet the burgeoning energy needs of the country was not forthcoming from the private coal mine owners. Unscientific mining practices adopted by some of them and poor working conditions of labour in some of the private coal mines became matters of concern for the Government. On account of these reasons, the Central Government took a decision to nationalise the private coal mines. The nationalisation was done in two phases, the first with the coking coal mines in 1971-72 and then with the non-coking coal mines in 1973. In October, 1971, the Coking Coal Mines (Emergency Provisions) Act, 1971 provided for taking over in public interest of the management of coking coal mines and coke oven plants pending nationalisation. This was followed by the Coking Coal Mines (Nationalisation) Act, 1972 under which the coking coal mines and the coke oven plants other than those with the Tata Iron & Steel Company Limited and Indian Iron & Steel Company Limited, were nationalised on 1.5.1972 and brought under the Bharat Coking Coal Limited (BCCL), a new Central Government Undertaking. Another enactment, namely the Coal Mines (Taking over of Management) Act, 1973, extended the right of the Government of India to take over the management of the coking and non-coking coal mines in seven States including the coking coal mines taken over in 1971. This was followed by the nationalisation of all these mines on 1.5.1973 with the enactment of the Coal Mines (Nationalisation) Act, 1973 which now is the piece of Central legislation determining the eligibility of coal mining in India.

COAL – INDIAN ENERGY CHOICE



Coal is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. The country's industrial heritage was built upon indigenous coal.

Commercial primary energy consumption in India has grown by about 700% in the last four decades. The current per capita commercial primary energy consumption in India is about 350 years which is well below that of developed countries. Driven by the rising population, expanding economy and a quest for improved quality of life, energy usage in India is expected to rise. Considering the limited reserve potentiality of petroleum & natural gas, eco-conservation restriction on hydel project and geo-political perception of nuclear power, coal will continue to occupy centre-stage of India's energy scenario.

Indian coal offers a unique ecofriendly fuel source to domestic energy market for the next century and beyond. Hard coal deposit spread over 27 major coalfields, are mainly confined to eastern and south central parts of the country. The lignite reserves stand at a level around 36 billion tonnes, of which 90 % occur in the southern State of Tamil Nadu.

6. DEEP-SEA MINING

Author Name: **Gourav Mukherjee**

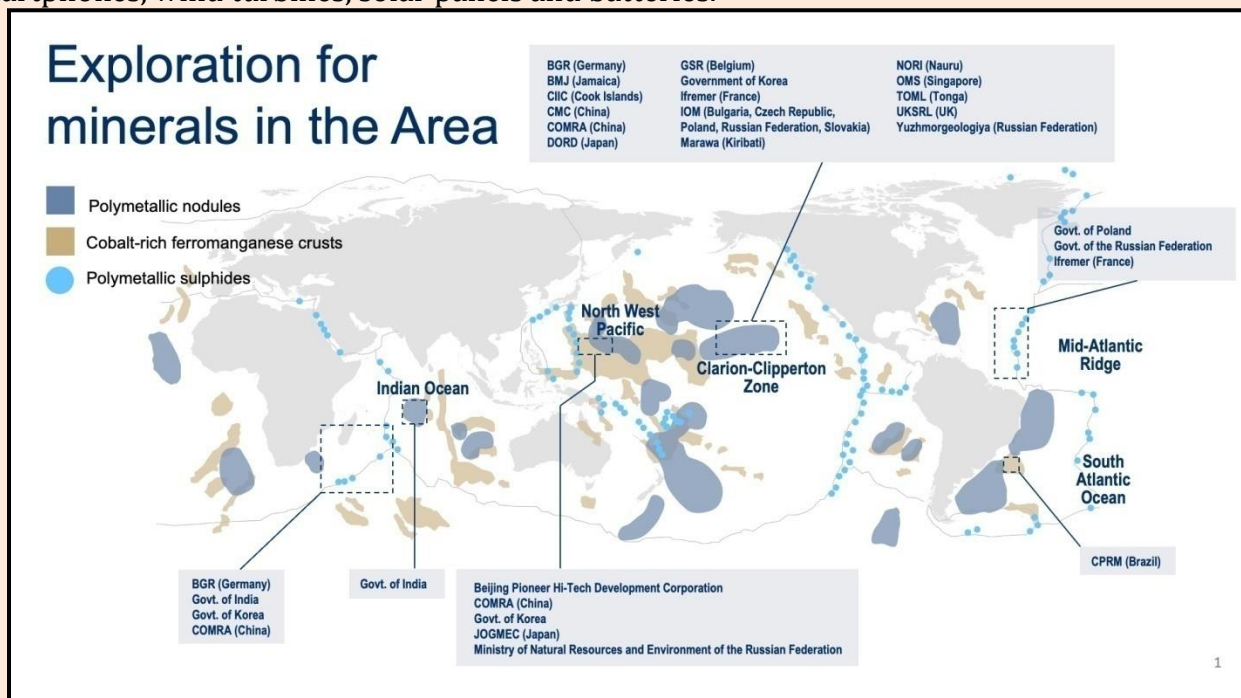
Semester: 5th

- **Deep-sea mining is the process of retrieving mineral deposits from the deep seabed** – the ocean below 200m.
- **Depleting terrestrial deposits and rising demand for metals** mean deep-sea mining may begin soon, even though research suggests that it could destroy habitats and **wipe out species**.
- **Deep-sea mining should be halted** until the criteria specified by IUCN are met, including the introduction of assessments, effective regulation and mitigation strategies.
- **Comprehensive studies** are needed to improve our understanding of deep-sea ecosystems and the vital services they provide to people, such as food and carbon sequestration.

What is the issue?

Deep-sea mining is the process of extracting and often excavating mineral deposits from the deep seabed. The deep seabed is the seabed at ocean depths greater than 200m, and covers about two-thirds of the total seafloor. Research suggests deep-sea mining could severely harm marine biodiversity and ecosystems, but we still lack the knowledge and means to implement protections.

Despite this, there is growing interest in the mineral deposits of the seabed. This is said to be due to depleting terrestrial deposits of metals such as copper, nickel, aluminium, manganese, zinc, lithium and cobalt. Demand for these metals is also increasing to produce technologies like smartphones, wind turbines, solar panels and batteries.



By May 2022, the International Seabed Authority (ISA), which regulates activities in the seabed beyond national jurisdiction ('the Area'), had issued 31 contracts to explore deep-sea mineral deposits. More than 1.5 million km² of international seabed, roughly the size of Mongolia, has been set aside for mineral exploration.

To date, the ISA has only issued exploration contracts, but is developing regulations to govern the transition to exploitation. In June 2021, the Government of Nauru notified the ISA of their intention to start deep-sea mining, triggering a rush to finalise the ISA regulations.

Mining in international waters could commence as soon as 2026; even though vital research and work to adopt the required regulations, standards and guidelines to manage deep-sea mining sustainably is far from complete.

Why is this important?

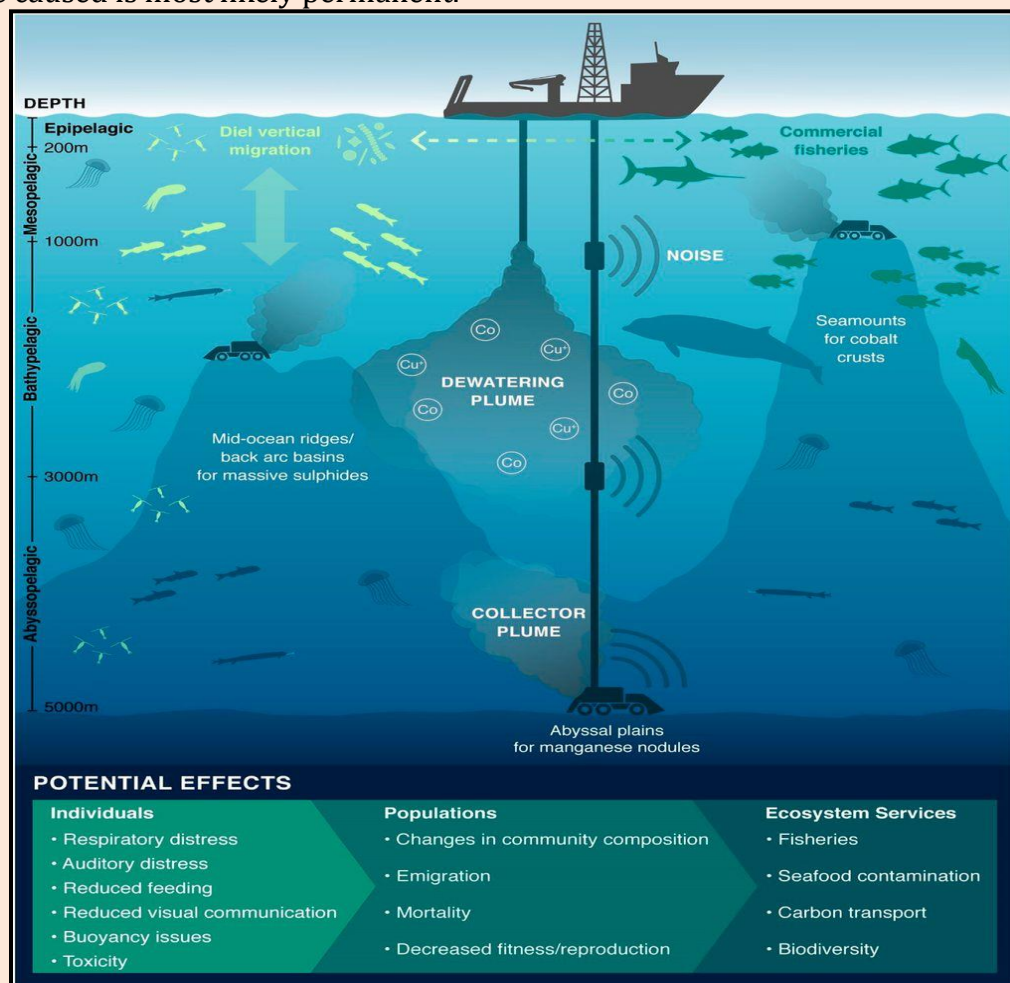
As the deep sea remains understudied and poorly understood, there are many gaps in our understanding of its biodiversity and ecosystems. This makes it difficult to assess the potential impacts of deep-sea mining or to put in place adequate safeguards to protect the marine environment, and the three billion people whose livelihoods depend on marine and coastal biodiversity.

The seafloor contains an extensive array of geological features. These include abyssal plains 3,500–6,500m below the sea surface, volcanic underwater mountains known as seamounts, hydrothermal vents with bursting water heated by volcanic activity, and deep trenches such as the Mariana Trench. These remote places support species that are uniquely adapted to harsh conditions, such as lack of sunlight and high pressure. Experts predict that many of these species are unknown to science.

Based on current knowledge of the deep sea, the following impacts of mining activities could affect its biodiversity and ecosystems:

Disturbance of the seafloor

The digging and gauging of the ocean floor by machines can alter or destroy deep-sea habitats. This leads to the loss of species, many of which are found nowhere else, and the fragmentation or loss of ecosystem structure and function. It is the most direct impact from deep-sea mining and the damage caused is most likely permanent.



Sediment plumes

Deep-sea mining will stir up fine sediments on the seafloor, creating plumes of suspended particles. This is exacerbated by mining ships discharging waste water at the surface. Scientists are concerned these particles may disperse for hundreds of kilometres, take a long time to resettle on the seafloor, and affect ecosystems and commercially important or vulnerable species. For instance, such plumes could smother animals, harm filter-feeding species, and block animals' visual communication.

Pollution

Species such as whales, tuna and sharks could be affected by noise, vibrations and light pollution caused by mining equipment and surface vessels, as well as potential leaks and spills of fuel and toxic products.

What can be done?

Under the United Nations Convention on the Law of the Sea (UNCLOS), the Area and its mineral resources are the common heritage of humankind. This means they must be managed on behalf of and in the interests of all humanity including through: the sharing of economic benefits; support for marine scientific research; and the effective protection of the marine environment.

At the IUCN World Conservation Congress in Marseille (September 2021), IUCN Members adopted **Resolution 122** to protect deep-ocean ecosystems and biodiversity through a **moratorium on deep-sea mining** unless and until a number of conditions are met. These include:

- The risks of mining are comprehensively understood and effective protection can be ensured;
- Rigorous and transparent impact assessments are conducted based on comprehensive baseline studies;
- The **Precautionary Principle** and the 'Polluter Pays Principle' are implemented;
- Policies incorporating circular economic principles to reuse and recycle minerals have been developed and implemented;
- The public are consulted throughout decision-making;
- The governance of deep-sea mining is transparent, accountable, inclusive, effective and environmentally responsible.

Reliance on metals from mining can be reduced by redesigning, reusing and recycling. In addition, research should focus on creating more sustainable alternatives to their use because deep-sea mining could irreparably harm marine ecosystems, and limit the many benefits the deep sea provides to humanity.



Chapter-5

Technical Magazine

Sparkle'2023

Civil Engineering Department

Name of the Editors:

- 1. Mr. Munmun Roy (HOD in-Charge)**
- 2. Mr. Jayanta Das (Lecturer)**

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1. 3D PRINTING IN CONSTRUCTION

Author Name: Roushan Kr. Mahato

building is constructed through step by step process. It is actually a long process. At first the drawing of the plan made by an architect. Then plan is sanctioned by corporation or municipal authority. After that some masons workers are engaged. Next the construction is started with bricks and cement.

But now the day our construction technology is going to done the fastest work in building, house apartment, and bridges through the help of 3D printing.

In 1894 'Charles chuck' firstly introduced the 3D concept toward us. 3D printing in construction is moving toward a future in which this technique and the related material mixtures will acquire a predominant role in the construction sector. This will allow for reduced costs, higher speed will sustainably accommodate the demands of an increasingly urbanized society.

Researchers believe the technology would be able to make a two-three house in just under a day. On the moon and in space, 3D printers could be used to create components and even print habitats for astronauts. 3D printers could one day build a house. 3D printing will be bigger, faster and cheaper.

The key for the new generation of printers, especially industrial-grade solutions, will be the ability to handle a greater range of advanced materials. This opens the door for businesses to benefit from additive manufacturing in areas where they previously could not.

The global 3D printing market size was valued at USD 16.75 billion in 2022 and is projected to grow at a compound annual growth rate (CAGR) of 23.3% from 2023 to 2030.

3D printing is already transforming the manufacturing landscape due to its speed, affordability, high level of customization, and ability to produce complex geometries. As the technology continues to mature, manufacturers will develop new and innovative 3D printing solutions.



2. Use of Useless Materials in Civil Engineering

Author Name: Jayanta Das,
Lecturer,CE

Construction and other industries around the world generate millions of tons of solid wastes every year. Waste material basically polluted the environment, so if we are using this waste material then we can reduce the environmental pollution and also used in construction. As we are belong from Engineering field, so if we use waste material as a replacement of costly materials then we can reduce the cost of construction without affecting the strength of the structure, durability and many more properties of structure. And also increase many properties of the structure with the addition of waste materials. Some of waste materials which is used in construction are as follows-

(1) Fly ash:-

Waste material fly ash which is generated from thermal power plant and if we are use this waste material as a replacement of cement by some percentage then we can reduce the cost of the structure, increase the workability of concrete, increase the impermeability as well as make the structure water tight.

(2) Saw dust:-

saw dust which is generated from wooden factory and if we use these waste material as a replacement of sand by some percentage without affecting the strength, then we can reduce the weight of the structure, make thermal resistant, frost proof and sound proof.

(3) Rice husk:-

Rice husk contains 85% to 95% of silica. As we know that silica provide strength to the structure, so if we used rice husk in concrete then increase compressive strength of the concrete, also increase the water proofing property.

(4) Slag:-

Slag is similar to fly ash; it is finer than standard Portland cement and is also cheaper as it is a process byproduct. It is produced by the steel production industry. Slag cement has good heat durability that can be used to prepare heat-resistant concrete because it contains a little calcium hydroxide after hardening and it is also the fire-resistant additive.

We can also use waste material as filler work in building, bridge etc.

So, if we are look in engineering field then waste materials are used as a construction material and make the construction economical, thermal resistant, water tight and also keep environment pollution free.

3. River Restoration

Author Name: Ayan

Semester:

Abstract: All India heads towards an ever-deepening water crisis. These include various initiatives to promote water conservation on the one hand, and on the other, to improve water use efficiency in industrial, domestic and agriculture section. Our goal is sustainability of water resources. We focus changing the environment through river and conserving the rivers increase the availability of water and stable environment for future. This report discusses issues related to Restoration of Rivers.

Introduction

River is the life line and blood line of India. The origin distribution of the main streams, this tributaries is known as River system .India is one of such country in the world which is bestowed with good number of rivers and tributaries , which are helpful not only in the field of agricultural but also in inland transport system of the country . River also from the basis for domestic and industrial water supply, generation of hydroelectricity, inland fishing are responsibly for deposition of fertile soil in the plains as well as formation of deltas .Most of the river in India either flow into the Arabian sea or the Bay of Bengal, which is determined by the water shed and the physical features of the country.

Creates policies for river Restoration

1. Ensure long – term (I. s. 530 years) provision of government funded resources to facilitate planning, implementation and evaluation of river restoration projects.
2. Streamline regulations and permission processes to aid implementation of small-scale, low risk restoration project.

The Future of River Restoration

1. Improved resilience to climate change impacts of increased hydrological extremes of drought and flood risk by improving water storage and attenuating peak flows.
2. Reduced river maintenance costs by reinstating natural processes and physical habitats

Conclusion

After focusing the major problems in the Environment, we take small step for preserving the environment. By Implementing, the process we can bring various solutions for the environment

& society. After this process or system the water table will be raised and stable the environment. Restoration of river can bring the huge changes to the environment.

4. Rain Water Harvesting

Author Name: Nikhil Kumar Singh

Semester:

Water is the basic essentiality for us and due to activities such as scanty rainfall and overpopulation, Rainwater harvesting is highly essential. Rainwater harvesting is the accumulation of rainwater for collecting, storing, and saving water to prevent water crisis and future use. Rain water is collected from the rooftop and is directed through tubes or pipelines into a storage tank to save the remaining water. Rainwater harvesting is of high quality and is a sustainable source of water.

Rain Water Filtration

Rainwater can be harvested or purified in multiple ways. The catch area before harvested must be cleaned thoroughly, and the pipelined must be flushed regularly. Initially, the water flow is diverted to wash or rinse the area. Rain water contains contaminants or other waste materials that affect the quality of the water. Contaminants such as dust, Bird excreta, pollution, leaves, and sand particles can affect water quality.

Filtration removes contaminants and other impurities and purifies rainwater for drinking and other purposes. However, the harvested water has to treated and tested before consumption to ensure the right quality check. Industries use the practice of pre-filtration to ensure that the purified water is directed water to the tank. The pre-filtration measure is a vital step that the water supply system should not compromise in terms of water quality.

Some techniques of rainwater purification are solar sterilization, use of chemicals like iodine or chlorine, or sediment filtration. However, harvested rainwater used for drinking purposes can be filtered through Reverse Osmosis (RO).

Conclusion

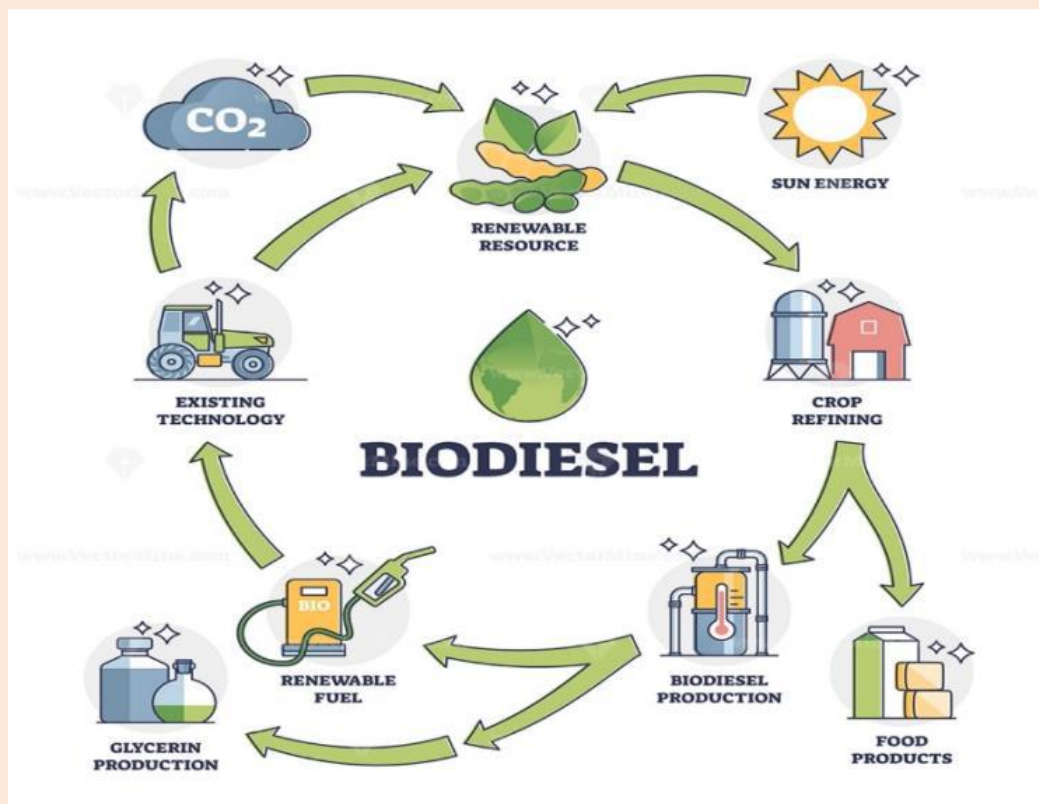
Thus, several methods incorporate water purification. Rainwater used as drinking water must not be consumed without purification and filtration.

5. BIO DIESEL

Author Name: Vishal Prasad

Semester:

Biodiesel is an alternative fuel similar to conventional or 'fossil' diesel. Biodiesel can be produced from straight vegetable oil, animal oil/fats, tallow and waste cooking oil. The process used to convert these oils to Biodiesel is called transesterification. This process is described in more detail below. The largest possible source of suitable oil comes from oil crops such as rapeseed, palm or soybean. In the UK rapeseed represents the greatest potential for biodiesel production. Most biodiesel produced at present is produced from waste vegetable oil sourced from restaurants, chip shops, industrial food producers such as Birdseye etc. Though oil straight from the agricultural industry represents the greatest potential source it is not being produced commercially simply because the raw oil is too expensive. After the cost of converting it to biodiesel has been added on it is simply too expensive to compete with fossil diesel. Waste vegetable oil can often be sourced for free or sourced already treated for a small price. (The waste oil must be treated before conversion to biodiesel to remove impurities). The result is Biodiesel produced from waste vegetable oil can compete with fossil diesel. More about the cost of biodiesel and how factors such as duty play an important role can be found [here](#). Biodiesel has many environmentally beneficial properties. The main benefit of biodiesel is that it can be described as 'carbon neutral'. This means that the fuel produces no net output of carbon in the form of carbon dioxide (CO₂). This effect occurs because when the oil crop grows it absorbs the same amount of CO₂ as is released when the fuel is combusted. In fact this is not completely accurate as CO₂ is released during the production of the fertilizer required to fertilize the fields in which the oil crops are grown. Fertilizer production is not the only source of pollution associated with the production of biodiesel, other sources include the esterification process, the solvent extraction of the oil, refining, drying and transporting. All these processes require an energy input either in the form of electricity or from a fuel, both of which will generally result in the release of green house gases. To properly assess the impact of all these sources requires use of a technique called life cycle analysis. Our section on LCA looks closer at this analysis. Biodiesel is rapidly biodegradable and completely non-toxic, meaning spillages represent far less of a risk than fossil diesel spillages. Biodiesel has a higher flash point than fossil diesel and so is safer in the event of a crash.



Once separated from the glycerin, the biodiesel is sometimes purified by washing gently with warm water to remove residual catalyst or soaps, dried, and sent to storage. In some processes this step is unnecessary. This is normally the end of the production process resulting in a clear amber-yellow liquid with a viscosity similar to petrodiesel. In some systems the biodiesel is distilled in an additional step to remove small amounts of color bodies to produce a colorless biodiesel.

6. Optimization of GGBS Fly Ash-Based Geopolymer Concrete Paver Blocks

Author Name: Munmun Roy, HOD In-Charge, CE

The production of conventional concrete (i.e., OPC) emits a massive volume of carbon dioxide (CO₂) to the environment that influences global warming. In the existing state of the art, the researchers have put sincere efforts to reduce the emission of ozone-depleting materials that affect global warming. To overcome the environmental problems, the researchers have started to introduce alternative cementitious materials in geopolymer concrete production (GPC). Production of GPC uses industrial by-product materials such as fly ash and ground granulated blast furnace slag (GGBS) as its constituents which is very much useful in the reduction of greenhouse gases by 80%. This paper focuses on development of geopolymer concrete paver blocks by using dry low-calcium-based fly ash (Class F) as its source material with GGBS as a proportion of 50–50% and Alkali Activator Solution (AAS) to Binder (B) ratio is 0.425%. This research presents the results of stress–strain plots of GPC with different ratios of constituents. Further, cost-effectiveness of GPC with respect to standard OPC is also established.

Mechanical Strength Optimization of Geopolymer Concrete Pavement Blocks

In this present study, sincere efforts are devoted to induce a proper design mix guideline for GPC with the primary focus on attending the maximum compression testing value in a reduced cost-effective way for various ratios of alkaline solutions to solid binder materials. In this present investigation, locally purchasable low calcium fly ash (FA) and ground granulated blast furnace slag (GGBS) as the solid dust materials, combined solution of NaOH and Na₂SiO₃ as an alkali solutions and graded aggregates are mixed on the basis of the guidelines of Indian standards (IS-10262:2019). This paper focuses on the development of geopolymer concrete Coro-lock paver blocks by a combination of FA with GGBS as a proportion of 40–60, 50–50, 60–40% and alkali activator solution (AAS)-to-binder (B) ratio (AAS/B) is ranged from 0.42 to 0.45%. This research presents the results of compression testing values, density, and water absorption of GPC with different ratios of constituents. Further, the cost-effectiveness of GPC with respect to standard OPC is also established. Correlation between the various proportions of FA-GGBS and 28-days compressive strength of geopolymer concrete Coro-lock paver blocks is experimented to predict

the rational method of design mix for GPC. In the experimental results, 28-days compressive strength of geopolymer concrete Coro-lock paver blocks is observed as high as 49.5 MPa.

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7. HAZARDOUS WASTE MANAGEMENT

Author Name: Neha Kumari

Semester: 5th Sem

Waste management is one of the vital environmental issues since last few decades. It has been noted that the generation of waste increases with increasing population, industrialization and urbanization etc. The waste management strategy includes both non-hazardous and hazardous waste management. Non hazardous waste does not cause potential threat to environment but instead hazardous waste is the waste that poses substantial or potential threats to public health and the environment. Rapidly growing industrial sector has contributed to the generation of large quantity of hazardous waste material. Therefore to reduce environmental hazard, proper attention is required during storage, segregation, transportation and disposal of hazardous waste, because it cannot be disposed as off in the environment.

The reduction of hazardous waste at the origin remains very important due to the high risk and cost of disposal. Hazardous waste can be reduced by using engineering and scientific management techniques. Hazardous waste is dangerous for the ecology. Hence, the reuse and recycling of hazardous waste is the best way to manage its generation. Hazardous waste treatment methods, including physical, chemical, biological, and thermal treatment, are comparatively expensive. Governments need to take necessary action to prevent marine environments from becoming polluted due to the massive disposal of hazardous waste directly into them. Landfills and surface impoundments options are suitable for solid and liquid hazardous waste, respectively, Injection wells are mainly used for different types and particular hazardous wastes as per their classes For safe disposal, underground disposal is found to be suitable compared to other surface disposal methods, as it has less chance of leakage, eliminates visual impacts, and is protected from natural phenomena. The regulations for disposal methods need to be modified from time to time by the governing agencies. Therefore, less production of hazardous waste seems to be an efficient option for the manufacturing and process industries. Adopting waste minimization techniques during the design of the processes is the most efficient way to overcome waste generation.

8. SELF CURING CONCRETE

Author Name: Nivedita Dutta

Construction industry is growing day by day even in remote areas and desert region. Even India and other countries are facing a lot of problems in supplying drinking water to their citizens. Hence construction industries are under pressure in finding out alternative curing methods of curing concrete. Self curing concrete is the one which can meet the present and future requirements of curing concrete. Concrete is primarily used building material. For curing of concrete we require large amount of water. Concrete is an universal construction material and cement, water and aggregates are its ingredients. The strength of concrete depend upon properties of its constituents and mix proportions and amount of hydration in the concrete. For the concrete hydration we require good quality of water in required amount.

Curing is the maintenance of a satisfactory moisture content and temperature in concrete for a period of time immediately following placing and finishing so that the desired properties may develop. Curing has a strong influence on the properties of hardened concrete proper curing will increase durability, strength, water tightness, abrasion resistance and resistance to freezing and thawing.

Curing of concrete plays a major role in developing the strength and hardness of concrete which leads to its improvement. Curing is a process of promoting the hydration of cement and consists of a control of temperature and of moisture movement from and into the concrete. Poor curing practices adversely affect the desirable properties of performance of concrete.

It has been pointed out earlier that curing does not means application of water it means also creation of condition for promotion of Uninterrupted and Progressive hydration. Concrete in which the mixing water is restricted by means of some chemicals compounds to go out from the concrete body is known as “ Self Curing Concrete”.

Some time works are carried out in place where there is acute shortage of water and the application of water curing is not possible for reasons of economy.

The compound molecules is primarily hydrophobic in nature with hydrophilic terminal group. Hydrophilic terminal group attaches itself to the film of bleeding water. While the long Hydrophobic chain maintains a vertical orientation away from the bleeding water. Water molecules do not possess sufficient energy to escape through the hydrophobic layer which results into quick reduction in the evaporation loss.

By using self curing concrete contractor can benefit by able to expedite the work schedule and placing more concrete while client benefits by obtaining concrete free of plastic shrinkage crack and having greater durability value.

9. URBAN DESIGN

Author Name:

Urban design is the art of creating and shaping cities and towns. It gives appearance, arrangement of cities and town . it creates public spaces, where people can live and communicate with each other. Urban design involves many different disciplines including planning, development, architecture, landscape architecture, engineering, economics, law and finance. The field of urban design is important because it strengthens in the planning and development of livable and workable surroundings. Urban designers are hired by government and commercial businesses to improve public spaces such as homes and community centres . Urban designers work to create inclusive cities that protect the commons, ensure equal access to and distribution of public goods, and meet the needs of all residents, particularly women , people of colour and other marginalized populations. Through design intervention, urban designers work to revolutions the way we conceptualize our social, political , and spatial systems as strategies to produce and reproduce a more equitable and innovative future. Urban design operates at many scales, from the macro scale of the urban structure (planning, zoning, transport and infrastructure networks) to the micro scale of street furniture and lighting . when fully integrated into policy and planning systems, urban design can be used to inform land use planning , infrastructure, built form and even the socio demographic mix of a place.

History of urban design in India

The beginnings of urban planning in India can be Traced back to the Indus valley civilisation's planned towns of Mohenjodaro and Harappa as early as 2500 BC. Cities and towns were also formed around forts and trade and commerce hubs throughout India's history. The city was spilt into two parts. A fort like structure was built to safeguard the city's higher and upper levels. Perhaps the governing class of the towns lived in the protected region. The second section of the town was lesser in elevation than the former, and common men lived there. Indus valley's main streets ran from north to south and east to west, meeting at right angles.



PORTION OF INDUS VALLEY

Modern urban design

New Delhi, India is a good example of urban design. It was planned by Edwin Lutyens and was influenced by nature. The combination of a strong straight axis in the middle with an avenue of trees at either end enhances the blend of modern and classical design.



10. BUILDING INFORMATION MODELING (BIM)

Author Name: Rashid Khan, 5th Sem

BIM is an acronym for Building Information Modeling or Building Information Management. It is highly collaborative processes that allows architects, engineers, real estate developers, manufacturers, and other construction professionals to plan, design, and construct a structure or building within one 3D model.

In the past, blueprints and drawings were used to express information about a particular building plan. This 2D approach made it very difficult to visualize dimensions and requirements. Next came CAD (Computer Aided Design), which helped drafters see the benefit of plans in a digital environment. Later on, CAD turned 3D, which brought more realistic visuals to blueprints. Now, BIM (Building Information Modelling) is the standard— but it is much more than just a 3D model.

Building information modeling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building is digitally constructed. This model, known as a building information model, can be used for planning, design, construction, and operation of the facility. It helps architects, engineers, and constructors visualize what is to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project.

With BIM technology, an accurate virtual model of a building, known as a building information model, is digitally constructed. When completed, the building information model contains precise geometry and relevant data needed to support the design, procurement, fabrication, and construction activities required to realize the building. After completion, this model can be used for operations and maintenance purposes. Building information modeling (BIM) is the future of building design and construction. BIM is a 3-D, object-oriented, CAD approach for architects and engineers. While the number of architects and building designers using BIM is modest the number will continue to increase. One of the most valuable functions of BIM is its ability to improve the coordination between multiple design disciplines, thus reducing errors. BIM has the potential to respond to an owner's need for predictable costs, quality, and on-time delivery.

It is important to note that BIM is not just software; it is a process and software. BIM means not only using three-dimensional intelligent models but also making significant changes in the workflow and project delivery processes. BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project. BIM also supports the concept of integrated project delivery, which is a novel project delivery approach to integrate people, systems, and business structures and practices into a collaborative process to reduce waste and optimize efficiency through all phases of the project life cycle.

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