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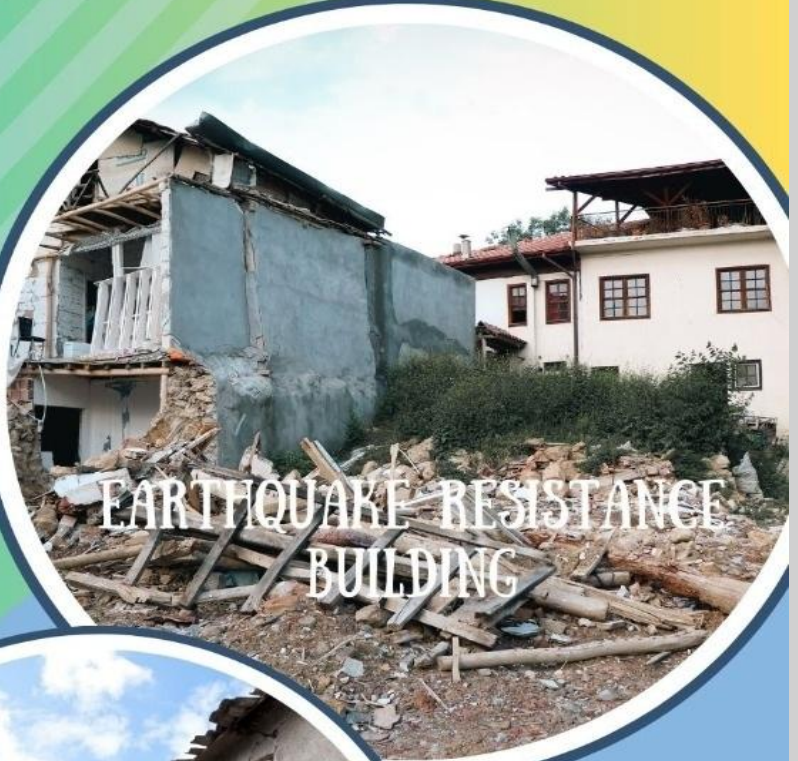
CIVITECH

BIANUAL TECH MAGAZINE

INNOVATION

RESEARCH

CIVIL ENGINEERING





VISION- MISSION

Institute Vision

To prepare skilled professionals with innovative, ethical, and entrepreneurial spirit.

Institute Mission

M-1: Develop Skilled Professionals– Prepare individuals to excel in evolving global industries through training, hands-on experience, collaboration with industries, and continuous learning.

M-2: Promote Innovation- Encourage creative problem-solving through hands-on research and real-world projects.

M-3: Build Ethical Leaders- Instill integrity, inclusivity, and a commitment to social responsibility in all students.

M-4: Inculcate Entrepreneurial Spirit- Prepare individuals into leaders and entrepreneurs for creating and managing companies.

Department Vision

To develop skilled, ethical civil engineers committed to sustainability and societal progress.

Department Mission

M1 Equip students with technical expertise, practical knowledge, and research-driven learning to tackle challenges in construction and infrastructure industries using advanced and sustainable solutions.

M2 Foster integrity, inclusivity, and sustainability in civil engineering for societal and global impact.

M3 Empower students as visionary leaders and innovators in civil engineering.



HOD'S MESSAGE



Bipas Mohanty
Head of Department

Dear Readers!!

It is with great pride and enthusiasm that I extend my warmest greetings to all of you as we present this edition of **CIVITECH**. This magazine serves as a vibrant platform to showcase insightful perspectives, thought-provoking discussions, and creative expressions that reflect the pulse of our dynamic community.

In an era where information flows rapidly, it is essential to engage in meaningful discourse and stay informed about the evolving socio-economic, cultural, and political landscapes. *Civitech* strives to be more than just a publication—it is a voice, a bridge, and a catalyst for ideas that inspire progress.

I extend my heartfelt gratitude to our dedicated editorial team, contributors, and readers who continue to make this magazine a beacon of knowledge and inspiration. Your passion and commitment are what keep this publication thriving.

As you turn these pages, I hope you find articles that inform, stories that inspire, and perspectives that challenge conventional thought. Let us continue to foster intellectual curiosity and create a platform for meaningful dialogue.

Happy reading!!

EDITOR'S MESSAGE



MS. Biswabharati Naik
Chief Faculty Editor
Civil Engineering (Diploma)

Dear Readers,

It is with great pleasure that I welcome you to the latest edition **CIVITECH**, the technical magazine of the Department of Civil Engineering. As we embrace a new year, this issue embodies the enthusiasm, innovation, and ground breaking advancements that define our field.

In this edition, we highlight pioneering research, remarkable student projects, and emerging technologies that are shaping the future of civil engineering. From advancements in sustainable energy and smart grids to the integration of artificial intelligence in automation, each article reflects the transformative potential of our discipline.

I extend my heartfelt appreciation to our contributors, editorial team, and readers whose dedication and engagement make *Civitech* a dynamic platform for knowledge exchange and discovery. Your continued support fuels the growth of this magazine and strengthens our academic and research community.

We hope this edition inspires, informs, and sparks new ideas, encouraging further exploration and innovation in the field of civil engineering.

Happy reading!



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The purpose of engineering is to enable people to improve the quality of their lives.
- A. P. J. Abdul Kalam

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Building Structures and Aerodynamics: The Science of Wind-Resistant Design

Aerodynamics plays a vital role in the design and construction of modern buildings. It involves the study of how air flows around and interacts with structures, influencing their stability, safety, and efficiency. As buildings reach greater heights and incorporate complex shapes, understanding aerodynamic forces becomes essential for ensuring structural integrity, minimizing wind-induced effects, and enhancing occupant comfort. By applying aerodynamic principles, civil engineers can create buildings that withstand wind loads, reduce energy consumption, and offer improved sustainability.

✓ 1. The Importance of Aerodynamics in Building Design

Aerodynamics is critical in building structures because of the forces exerted by wind, which can cause:

- **Drag force:** The resistance force acting opposite to the wind direction, affecting the building's stability.
- **Lift force:** The upward or downward force caused by differences in air pressure on different building surfaces.
- **Turbulence and vortex shedding:** The irregular airflow patterns that create oscillating forces, which can cause vibrations and structural fatigue.

Buildings designed without proper aerodynamic considerations may experience structural instability, excessive sway, and discomfort for occupants due to wind-induced motion.

⚙️ 2. Wind Effects on Building Structures

Tall buildings, bridges, and towers face significant aerodynamic challenges due to their exposure to high wind speeds.

- **Wind load and pressure:** Wind creates varying pressure zones around a building. The windward face experiences positive pressure, while the leeward face experiences negative pressure, leading to potential structural stress.
 - **Vortex shedding:** When wind flows around a building, it can create alternating low-pressure zones, causing the structure to oscillate. This can result in dangerous vibrations if the frequency matches the building's natural frequency.
 - **Wind tunnels and computational fluid dynamics (CFD):** Engineers use wind tunnel testing and CFD simulations to model and predict airflow patterns, allowing them to optimize building shapes and reduce aerodynamic drag.
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✂️ 3. Aerodynamic Design Strategies

To mitigate wind-induced effects, civil engineers implement various aerodynamic strategies in building design:

- **Tapering and twisting shapes:** Skyscrapers often have tapered or twisted profiles, which reduce wind resistance by disrupting vortex formation. Examples include the **Burj Khalifa** in Dubai and the **Shanghai Tower**, whose twisting forms minimize wind load.
 - **Rounded and streamlined edges:** Rounded building corners reduce drag by allowing smoother airflow, decreasing wind pressure.
 - **Porous or ventilated facades:** Using perforated or porous building facades allows wind to pass through, reducing the overall wind force acting on the structure.
 - **Mass dampers and tuned mass systems:** These are counterbalancing weights installed in tall buildings to reduce wind-induced vibrations. The **Taipei 101** uses a tuned mass damper to stabilize the structure during high winds.
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✿ 4. Sustainable and Energy-Efficient Aerodynamics

Aerodynamic building design also contributes to energy efficiency and sustainability.

- **Natural ventilation:** Aerodynamic building shapes promote passive cooling by directing wind through specific channels, reducing the need for mechanical ventilation.
 - **Wind deflectors and canopies:** Strategically placed wind deflectors direct airflow, reducing wind pressure on pedestrian areas and improving outdoor comfort.
 - **Energy-efficient facades:** Modern buildings incorporate aerodynamic façades with movable panels that optimize wind flow and reduce energy consumption.
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🦋 5. Real-World Applications of Aerodynamic Design

Some iconic buildings incorporate advanced aerodynamic principles:

- **The Gherkin (30 St Mary Axe) in London:** Its rounded, tapered shape reduces wind resistance and improves energy efficiency.
 - **One World Trade Center (New York):** Designed with chamfered edges and a tapered form to reduce wind forces and prevent dangerous wind vortices.
 - **Petronas Towers (Kuala Lumpur):** The cylindrical shape reduces wind drag and enhances structural stability.
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✓ 6. The Role of Computational Aerodynamics

Modern civil engineering heavily relies on computational fluid dynamics (CFD) to simulate wind effects during the design phase.

- **Wind load prediction:** CFD models simulate how air flows around buildings, allowing engineers to identify areas of high pressure and turbulence.
 - **Design optimization:** By visualizing airflow patterns, engineers can optimize building shapes to reduce wind forces.
 - **Pedestrian comfort analysis:** CFD helps assess how wind affects pedestrian areas, ensuring safety and comfort around large structures.
-

🌐 7. The Future of Aerodynamic Building Design

As buildings become taller and more complex, the role of aerodynamics will continue to grow.

- **Smart buildings with adaptive facades:** Future structures may feature dynamically adjustable facades that respond to wind conditions in real time, optimizing energy efficiency.
 - **Aerodynamic wind turbines in buildings:** Integrating small wind turbines into the structure itself will generate clean energy, improving sustainability.
 - **Wind-responsive architecture:** Advanced materials and fluid mechanics will enable buildings that self-adjust to reduce wind loads and vibrations.
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❁ Conclusion

Aerodynamics is a fundamental aspect of building design, influencing both safety and sustainability. By applying aerodynamic principles, civil engineers create structures that can withstand wind forces, reduce energy consumption, and provide better comfort for occupants. As technology continues to advance, aerodynamic innovations will shape the future of architecture, allowing for the construction of taller, safer, and more sustainable buildings.

Abinash Mohanta
Faculty, Civil Engg.

Rainfall Analysis: Importance, Methods, and Applications

Rainfall analysis is a critical process in hydrology and meteorology that involves measuring, recording, and interpreting precipitation data. It plays a vital role in water resource management, agricultural planning, flood control, and infrastructure design. By analysing rainfall patterns, engineers, scientists, and policymakers can make informed decisions to mitigate water-related risks, enhance water conservation, and optimize land use planning.

✓ 1. The Importance of Rainfall Analysis

Rainfall is a primary source of freshwater, and its distribution significantly impacts ecosystems, human activities, and the environment. Accurate rainfall analysis is essential for:

- **Water resource management:** Understanding rainfall patterns helps in planning the storage, distribution, and use of water resources, such as reservoirs, dams, and irrigation systems.
 - **Flood and drought prediction:** Analyzing rainfall data allows authorities to predict and prepare for floods or droughts, reducing damage and ensuring public safety.
 - **Agricultural planning:** Rainfall analysis aids farmers in crop selection, planting schedules, and irrigation planning, improving agricultural productivity.
 - **Urban drainage design:** Engineers use rainfall data to design storm water management systems, preventing urban flooding.
 - **Climate change studies:** Long-term rainfall analysis helps monitor climate trends, detect changes in precipitation patterns, and assess the impact of global warming.
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🔧 2. Methods of Rainfall Measurement

Accurate rainfall analysis requires precise data collection through various measurement techniques.

- **Rain gauges:** The most common tool for measuring rainfall, rain gauges collect and measure the amount of precipitation over a specific time. Types of rain gauges include:
 - **Standard rain gauge:** Measures rainfall manually.
 - **Tipping bucket rain gauge:** Automatically records rainfall intensity by counting bucket tips.
 - **Weighing rain gauge:** Measures rainfall weight, offering higher accuracy.
 - **Radar and satellite systems:** Remote sensing technology uses radar and satellites to track large-scale rainfall patterns, providing data over vast areas.
 - **Weather stations:** Automated weather stations monitor rainfall in real time, offering continuous data for analysis.
 - **Disdrometers:** These advanced instruments measure the size, velocity, and distribution of raindrops, helping in detailed rainfall analysis.
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📊 3. Techniques of Rainfall Analysis

Rainfall analysis involves various statistical and computational methods to interpret data and forecast precipitation trends.

- **Time series analysis:** This method studies rainfall patterns over time to identify trends, seasonal variations, and anomalies.
 - **Rainfall intensity-duration-frequency (IDF) curves:** These curves represent the relationship between rainfall intensity, duration, and frequency, helping engineers design storm water infrastructure.
 - **Spatial analysis:** GIS (Geographic Information Systems) and remote sensing technologies map and visualize rainfall distribution over regions.
 - **Trend analysis:** Detects long-term changes in rainfall patterns, aiding in climate change assessment.
 - **Hydrological modelling:** Simulates the impact of rainfall on water bodies, aiding in flood prediction and water resource management.
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◆ 4. Applications of Rainfall Analysis

Rainfall analysis is widely applied in various fields to support sustainable development and disaster management.

- **Flood risk assessment:** Engineers use rainfall data to estimate flood risks, design drainage systems, and develop flood maps.
 - **Agriculture and irrigation planning:** Rainfall analysis helps farmers optimize water usage, plan irrigation schedules, and protect crops from drought.
 - **Water supply management:** Municipal authorities rely on rainfall data to manage water reservoirs and prevent water shortages.
 - **Infrastructure design:** Engineers use rainfall data in the design of roads, bridges, and buildings to ensure proper drainage and structural stability.
 - **Disaster preparedness:** Governments use rainfall analysis to issue early warnings for heavy rain, floods, and landslides, improving public safety.
-

🌐 5. Challenges in Rainfall Analysis

Despite its importance, rainfall analysis faces several challenges:

- **Data accuracy and consistency:** Variations in data collection methods and instrument accuracy can lead to inconsistencies.
 - **Spatial and temporal variability:** Rainfall patterns are highly variable across regions and seasons, making accurate prediction difficult.
 - **Climate change impacts:** Increasing climate variability makes it harder to predict long-term rainfall patterns, requiring advanced modelling techniques.
 - **Limited monitoring infrastructure:** In some regions, the lack of weather stations or monitoring systems results in insufficient rainfall data.
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✿ 6. Future Trends in Rainfall Analysis

Technological advancements are transforming rainfall analysis, making it more accurate and efficient.

- **Artificial intelligence (AI) and machine learning:** AI algorithms enhance rainfall prediction accuracy by analyzing large datasets and identifying complex patterns.
 - **Remote sensing and GIS:** Improved satellite technology provides more precise rainfall mapping, aiding in large-scale water resource management.
 - **Real-time monitoring systems:** Automated weather stations and IoT (Internet of Things) devices enable real-time rainfall tracking, enhancing early warning systems.
 - **Climate modelling:** Advanced climate models simulate future rainfall patterns, helping policymakers plan for climate resilience.
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✓ 7. Conclusion

Rainfall analysis is a fundamental tool for managing water resources, mitigating natural disasters, and supporting sustainable development. By measuring, analysing, and interpreting rainfall data, engineers and scientists can develop effective solutions for flood control, agricultural planning, and infrastructure design. As technology continues to evolve, rainfall analysis will become more accurate and accessible, playing an increasingly vital role in addressing global water challenges and adapting to climate change.

Biswabharati Naik,
Faculty, Civil Engineering

Advances in Civil Engineering Materials

The field of **civil engineering materials** has witnessed significant advancements in recent years, driven by the need for **durability, sustainability, and efficiency** in construction. Innovative materials are enhancing the strength, longevity, and environmental performance of infrastructure, while also reducing construction costs and carbon footprints.

1. Self-Healing Concrete

One of the most ground-breaking developments in civil engineering is **self-healing concrete**. Concrete is prone to cracking over time, which can lead to structural deterioration. Self-healing concrete contains **bacteria or microcapsules of healing agents** that activate when cracks form. These agents produce calcium carbonate, sealing the cracks and restoring the material's integrity. This innovation extends the lifespan of structures and reduces maintenance costs.

2. Ultra-High-Performance Concrete (UHPC)

UHPC is an advanced form of concrete that offers **exceptional strength, durability, and resistance to environmental factors**. It contains fine powders, fibres, and super plasticizers, resulting in a denser and more resilient material. UHPC is used in **bridges, high-rise buildings, and precast components**, offering longer service life and reduced material usage.

3. Geopolymers

Geopolymers are sustainable alternatives to traditional Portland cement. Made from **industrial by-products** such as fly ash and slag, they reduce carbon emissions during production. Geopolymer concrete offers **high thermal resistance, durability, and chemical stability**, making it ideal for infrastructure in harsh environments.

4. Transparent and Translucent Concrete

Transparent concrete, made by embedding **optical fibers** into the mixture, allows light to pass through, creating visually appealing structures. It is used in **architectural facades, flooring, and decorative panels**, offering both aesthetic and functional benefits, such as reduced energy consumption through natural lighting.

5. Carbon Fiber Reinforced Polymer (CFRP)

CFRP is a lightweight yet incredibly strong material used for **structural strengthening and retrofitting**. It offers **high tensile strength, corrosion resistance, and flexibility**, making it ideal for reinforcing aging infrastructure, such as bridges and buildings, without adding significant weight.

6. Smart Materials

Smart materials embedded with **sensors and shape-memory properties** are transforming civil engineering. These materials can detect stress, temperature changes, or damage in real time, enabling **predictive maintenance**. For example, **smart concrete** with embedded sensors can monitor structural health and prevent failures.

7. 3D-Printed Construction Materials

3D printing technology has introduced **innovative construction materials**, including printable concrete and composite polymers. These materials allow for **faster, cost-effective, and customizable construction** with reduced waste.

Conclusion

Advances in civil engineering materials are driving the industry toward **more sustainable, durable, and efficient construction practices**. From self-healing concrete to smart materials and 3D-printed components, these innovations are enhancing the **performance, resilience, and longevity** of modern infrastructure. As technology evolves, civil engineers will continue to adopt and refine these materials to meet future challenges.

Dayanidhi Kanar

3rd Sem Diploma CE

Introduction to Industrial Safety Practices

Industrial safety practices refer to the **measures, regulations, and protocols** implemented in workplaces to prevent accidents, protect workers, and promote a safe working environment. In industries such as **manufacturing, construction, mining, transportation, and energy**, safety is a top priority due to the potential hazards associated with heavy machinery, chemicals, and complex processes. Effective safety practices not only safeguard employees but also improve productivity, reduce downtime, and enhance overall operational efficiency.

1. Importance of Industrial Safety

The primary objective of industrial safety is to **prevent accidents, injuries, and fatalities**. By identifying and mitigating risks, organizations create a safer work environment. Safety practices also **protect equipment, prevent property damage**, and ensure compliance with legal standards, such as **Occupational Safety and Health Administration (OSHA)** regulations. Furthermore, maintaining a safe workplace boosts employee morale and reduces absenteeism.

2. Key Elements of Industrial Safety Practices

Industrial safety practices involve several core components:

- **Risk Assessment and Hazard Identification:**

Conducting regular **risk assessments** helps identify potential hazards in the workplace, such as chemical exposure, machinery malfunctions, or electrical risks. Identifying these hazards allows companies to implement effective control measures.

- **Personal Protective Equipment (PPE):**

Workers are required to wear **PPE** to protect themselves from physical, chemical, and biological hazards. This includes **helmets, gloves, safety goggles, respirators, and protective clothing**, depending on the nature of the work.

- **Safety Training and Education:**

Regular **safety training programs** educate employees about proper safety protocols, emergency procedures, and the safe handling of equipment. Well-trained employees are better equipped to prevent accidents and respond effectively in emergencies.

- **Machine and Equipment Safety:**

Proper **machine guarding, lockout/tagout (LOTO) procedures**, and regular equipment maintenance prevent mechanical accidents. Automated safety systems, such as emergency shut-offs and warning alarms, further enhance safety.

- **Fire Safety and Emergency Preparedness:**

Industries implement **fire safety protocols**, including the use of fire extinguishers, sprinkler systems, and evacuation plans. Regular **emergency drills** ensure employees are prepared for fires, chemical spills, or other emergencies.

- **Ergonomics and Workplace Design:**

To prevent **repetitive strain injuries (RSIs)** and musculoskeletal disorders, industries incorporate **ergonomic practices**, such as adjustable workstations, proper lifting techniques, and anti-fatigue mats.

3. Technological Advancements in Industrial Safety

Modern industries are increasingly using **technology to enhance safety practices**.

- **IoT-based sensors** detect gas leaks, temperature changes, and hazardous conditions in real time.
- **Wearable safety devices** monitor workers' vital signs and alert supervisors to potential health issues.
- **AI-powered analytics** identify safety trends and predict risks, helping organizations implement preventive measures.

4. Conclusion

Industrial safety practices are essential for **protecting workers, equipment, and the environment**. By prioritizing safety through **risk assessment, training, PPE usage, and advanced technologies**, industries can reduce accidents, improve efficiency, and foster a culture of safety. As industrial processes evolve, continuous improvements in safety practices will remain crucial for ensuring a secure and productive work environment.

**Anjali Bihari,
3rd Sem Diploma CE**

Waste Management: An Overview

Waste management refers to the **collection, transportation, processing, recycling, and disposal of waste materials** in a safe and environmentally responsible manner. It is a critical practice aimed at reducing the harmful effects of waste on **human health, the environment, and the economy**. With rising population levels, urbanization, and industrialization, effective waste management has become essential for promoting sustainability and public well-being.

1. Types of Waste

Waste is broadly categorized into the following types:

- **Municipal Solid Waste (MSW):** This includes **household waste**, such as food scraps, paper, plastic, and packaging materials. MSW is the most common type of waste generated in urban areas.
- **Industrial Waste:** Produced by manufacturing and industrial processes, it includes **chemical waste, metal scraps, and hazardous by-products**.
- **Biomedical Waste:** Generated by **hospitals, clinics, and laboratories**, this includes infected dressings, syringes, and pharmaceutical waste.
- **Agricultural Waste:** Originating from **farming activities**, it consists of crop residues, fertilizers, pesticides, and animal manure.
- **E-waste:** Discarded **electronic devices**, such as computers, phones, and batteries, contain hazardous materials like lead and mercury.

2. Waste Management Methods

There are several methods used for waste management, each with its own benefits and limitations:

- **Waste Reduction and Prevention:** The most effective form of waste management is **reducing waste at the source** by minimizing unnecessary consumption, promoting sustainable packaging, and encouraging reuse practices.
- **Recycling and Reuse:** Recycling involves **processing waste materials into new products**, reducing the need for raw materials. Materials such as **paper, glass, metal, and plastic** can be recycled. Reusing items, such as containers and clothing, extends their lifespan and reduces waste generation.
- **Composting:** Organic waste, such as **food scraps and yard trimmings**, can be composted into nutrient-rich soil amendments. Composting reduces landfill waste and supports sustainable agriculture.
- **Incineration:** This method involves **burning waste at high temperatures**, converting it into ash, heat, and gas. It reduces the volume of waste and generates **energy** but can release pollutants if not properly managed.
- **Landfilling:** Non-recyclable and non-compostable waste is often disposed of in **landfills**. Modern landfills are designed with **liners and leachate collection systems** to prevent soil and water contamination. However, they still contribute to **greenhouse gas emissions**.

3. Importance of Waste Management

Effective waste management is crucial for:

- **Environmental Protection:** Improper waste disposal can lead to **air, water, and soil pollution**. Proper management reduces contamination and protects ecosystems.
- **Public Health:** Waste management prevents the spread of diseases by **controlling hazardous waste and reducing exposure** to harmful substances.
- **Resource Conservation:** Recycling and composting conserve **natural resources** by reducing the demand for raw materials.
- **Economic Benefits:** Waste management supports **green jobs** in recycling, composting, and waste processing industries.

4. Technological Advancements in Waste Management

Modern waste management incorporates **innovative technologies** to improve efficiency:

- **Waste-to-energy (WTE) plants** convert non-recyclable waste into electricity or heat.
- **Smart waste bins** equipped with IoT sensors monitor waste levels and optimize collection routes.
- **AI-powered sorting systems** enhance recycling efficiency by automating the separation of recyclable materials.

5. Challenges and Future Outlook

Despite progress, waste management faces challenges such as **inadequate infrastructure, illegal dumping, and plastic pollution**. Moving forward, governments and organizations must adopt **sustainable waste management strategies**, including **circular economy practices**, where waste is treated as a resource rather than discarded.

Conclusion

Waste management is essential for **protecting the environment, conserving resources, and promoting public health**. Through **recycling, composting, waste-to-energy technologies, and sustainable policies**, societies can minimize waste's impact and move towards a greener, more sustainable future.

Bikash Pradhan,

5TH sem civil

Water Resources and Industries

Water is a vital natural resource that plays a critical role in industrial activities. Industries rely heavily on water for various processes, including manufacturing, cooling, cleaning, and transporting goods. Water is also used as a raw material in industries such as food and beverage production, pharmaceuticals, textiles, and chemical processing. Additionally, power generation plants, including hydroelectric and thermal power stations, consume vast amounts of water for operations.

The relationship between water resources and industries is both essential and complex. On one hand, industries drive economic growth and create employment, but on the other hand, they significantly impact water resources. Industrial activities often lead to water pollution by discharging untreated or inadequately treated wastewater into rivers, lakes, and oceans. This contamination affects aquatic ecosystems, reduces the quality of freshwater resources, and threatens public health.

Efficient water management is crucial for sustainable industrial practices. Many industries are adopting water conservation measures such as recycling and reusing water, treating wastewater before disposal, and using water-efficient technologies. Governments and environmental agencies enforce regulations and standards to control water pollution and promote responsible water use.

Water scarcity is becoming a growing concern due to increasing industrial demands and population growth. Industries must adopt sustainable water management strategies to minimize their water footprint and protect this essential resource. Collaboration between industries, governments, and environmental organizations is necessary to ensure the long-term availability and quality of water resources.

In conclusion, while industries are dependent on water for their operations, they must prioritize responsible water usage and pollution control. Sustainable industrial practices are essential to preserve water resources, ensuring their availability for future generations.

Annu Majhi,

5th Sem. Civil (Diploma)

Structural chemistry is a branch of chemistry that deals with the three-dimensional arrangement of atoms and molecules in a substance. It focuses on understanding how the spatial organization of atoms influences the chemical and physical properties of compounds. The construction of structural chemistry involves several fundamental concepts, including atomic structure, chemical bonding, molecular geometry, and intermolecular forces.

1. Atomic Structure and Chemical Bonding

At the core of structural chemistry is the atom, composed of a nucleus (protons and neutrons) surrounded by electrons in orbitals. The behaviour and interaction of these electrons determine the type of chemical bonds formed between atoms. The three primary types of bonds are:

- **Ionic Bonds:** Formed through the transfer of electrons between atoms, typically between metals and non-metals. The resulting charged ions attract each other, creating a strong electrostatic force.
- **Covalent Bonds:** Result from the sharing of electrons between two or more non-metal atoms. Covalent bonds can be polar (unequal sharing) or non-polar (equal sharing).
- **Metallic Bonds:** Occur between metal atoms, where electrons form a "sea" of free-moving charges, giving metals their characteristic properties like conductivity and malleability.

2. Molecular Geometry and VSEPR Theory

The shape of a molecule is determined by the arrangement of atoms and the repulsion between electron pairs. The **Valence Shell Electron Pair Repulsion (VSEPR)** theory explains how electron pairs around a central atom arrange themselves to minimize repulsion, resulting in specific molecular geometries such as linear, trigonal planar, tetrahedral, and octahedral. Molecular geometry influences properties like polarity, reactivity, and boiling/melting points.

3. Crystalline and Amorphous Structures

In solid-state chemistry, substances can have either crystalline or amorphous structures.

- **Crystalline structures** have a regular, repeating pattern of atoms, as seen in salt, diamonds, and metals. Their symmetry and order determine properties such as melting point, hardness, and conductivity.
- **Amorphous structures**, like glass and plastics, lack this regular arrangement, resulting in different physical characteristics, such as lower melting points and irregular shapes.

4. Intermolecular Forces

Beyond bonding, the interactions between molecules play a vital role in structural chemistry. These include:

- **Van der Waals forces:** Weak attractions between temporary dipoles.
- **Dipole-dipole interactions:** Occur between polar molecules.
- **Hydrogen bonds:** Stronger interactions between a hydrogen atom and electronegative atoms (O, N, or F), significantly affecting boiling points and solubility.

5. Applications in Construction and Materials Science

Structural chemistry principles are essential in material science and construction. Understanding how atoms bond and organize helps in designing stronger alloys, durable polymers, and advanced composites used in construction. For example, structural modifications in concrete and steel improve their strength and resilience. Nanotechnology, which relies heavily on structural chemistry, creates enhanced materials with superior properties, such as self-healing concrete and corrosion-resistant coatings.

Conclusion

The construction of structural chemistry is based on the principles of atomic bonding, molecular geometry, and intermolecular interactions. These concepts are fundamental in understanding the physical and chemical properties of materials, making structural chemistry a cornerstone of innovation in science and industry.

Geeta Nag,

3rd Sem Civil Engg.

1. What is Soil Foundation?

Soil foundation refers to the load-bearing layer of soil that supports structures such as buildings, bridges, and roads. It plays a critical role in construction by distributing the weight of the structure evenly, preventing excessive settlement, and ensuring stability. The foundation transfers the load from the building to the underlying soil or rock, which must be capable of bearing the load safely.

Understanding the properties of soil is essential for designing durable and stable foundations. Different soil types have varying bearing capacities, permeability, and compaction properties, all of which influence the foundation design.

2. Importance of Soil Foundation in Construction

The foundation is the most critical part of any structure, as it ensures:

- **Stability:** A strong foundation prevents uneven settlement and structural failure.
 - **Load Distribution:** It evenly spreads the load over a large area, reducing pressure on the underlying soil.
 - **Protection Against Natural Forces:** Foundations help resist forces caused by earthquakes, wind, and soil movement.
 - **Prevention of Moisture Damage:** In regions with high water tables, proper foundations prevent water infiltration, protecting the building from damage.
-

3. Types of Soil Foundations

Foundations are broadly classified into two categories: **shallow foundations** and **deep foundations**.

✓ Shallow Foundations

These are used when the load of the structure is light, and the soil near the surface has sufficient load-bearing capacity. Types of shallow foundations include:

- **Spread Footing:** A common foundation type where individual columns rest on square or rectangular footings that distribute the load evenly.
- **Mat or Raft Foundation:** A large concrete slab covering the entire base of the structure, used when soil bearing capacity is low.
- **Strip Foundation:** A continuous strip of concrete that supports walls, used in residential buildings.

✓ Deep Foundations

These are used for heavy structures or in areas where the upper soil layers are weak. Deep foundations transfer the load to deeper, stronger soil or rock layers. Types include:

- **Pile Foundation:** Long cylindrical columns driven deep into the ground, providing support for heavy loads.
- **Pier Foundation:** Large-diameter cylindrical columns used in bridge construction.
- **Caissons:** Watertight retaining structures, often used in underwater construction.

4. Soil Testing and Analysis

Before constructing a foundation, soil testing is essential to determine its properties. Key soil parameters include:

- **Bearing Capacity:** The soil's ability to support the load without excessive settlement.
 - **Compaction:** The process of increasing soil density to improve its load-bearing capacity.
 - **Moisture Content:** Soil with high moisture may lead to instability.
 - **Permeability:** The rate at which water passes through the soil, affecting drainage and erosion resistance.
-

5. Challenges in Soil Foundation Construction

Soil foundation engineering comes with challenges, such as:

- **Soil Settlement:** Uneven settling of the soil can lead to structural damage.
 - **Soil Erosion:** Water infiltration can weaken the foundation over time.
 - **Expansive Soils:** Clay-rich soils can expand and contract with moisture changes, causing foundation instability.
-

6. Conclusion

Soil foundation is the backbone of any construction project, providing stability and load-bearing support. A thorough understanding of soil properties, along with proper foundation design, ensures the longevity and safety of structures. Effective soil testing, appropriate foundation selection, and preventive measures against settlement and erosion are vital for successful construction projects.

Bhujbal Majhi,

5th Sem Civil Engg.

Hydraulics and Perennials in Mechanical Systems

1. Introduction to Hydraulics in Mechanical Systems

Hydraulics is a branch of science and engineering that deals with the mechanical properties and behavior of liquids, primarily water or oil, in motion and at rest. In mechanical systems, hydraulics is widely used to generate, control, and transmit power through pressurized fluid. Hydraulic systems play a crucial role in various industries, including construction, transportation, manufacturing, and agriculture.

The fundamental principle behind hydraulics is **Pascal's Law**, which states that a change in pressure applied to an enclosed fluid is transmitted equally throughout the fluid. This principle allows hydraulic systems to multiply force, making them efficient for heavy-duty applications.

2. Components of a Hydraulic System

A typical hydraulic system consists of the following components:

- **Hydraulic Pump:** Converts mechanical energy into hydraulic energy by pressurizing the fluid.
 - **Hydraulic Fluid:** The medium used to transfer energy. It also acts as a lubricant and heat dissipator.
 - **Valves:** Control the flow, direction, and pressure of the fluid.
 - **Actuators:** Convert hydraulic energy into mechanical motion (e.g., hydraulic cylinders and motors).
 - **Reservoir:** Stores and cools the hydraulic fluid.
 - **Filters:** Remove contaminants to protect the system.
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3. Applications of Hydraulics in Mechanical Systems

Hydraulics are used in numerous mechanical systems, including:

- **Heavy Machinery:** Excavators, cranes, and bulldozers use hydraulic systems for lifting and digging operations.
 - **Automotive Systems:** Hydraulic brakes and power steering systems provide precise control and efficiency.
 - **Industrial Machines:** Hydraulic presses and molding machines are used in manufacturing.
 - **Aircraft and Marine:** Hydraulic systems control landing gear, flaps, and steering systems.
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4. Advantages of Hydraulic Systems

- **High Power-to-Weight Ratio:** Hydraulic systems can handle large loads with relatively small components.
 - **Precision and Control:** Accurate control of speed, force, and movement.
 - **Smooth and Reliable Operation:** Hydraulics offer consistent and stable performance, making them ideal for heavy machinery.
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5. Perennial Concepts in Mechanical Systems

In mechanical engineering, the term **perennial** refers to systems or components that are designed for long-term, continuous, and reliable operation. These systems are meant to withstand wear and tear, function efficiently over time, and require minimal maintenance.

☒ Characteristics of Perennial Mechanical Systems

- **Durability:** Made from high-strength materials that can endure constant stress.
- **Reliability:** Engineered for consistent performance over extended periods.
- **Low Maintenance:** Designed with minimal moving parts or with self-lubricating mechanisms.
- **Energy Efficiency:** Optimized for continuous operation with minimal energy consumption.

☒ Examples of Perennial Mechanical Systems

- **Hydraulic Power Plants:** Hydroelectric power stations use water-driven turbines designed for long-term operation.
- **Industrial Hydraulic Presses:** Built for repetitive, high-load cycles with minimal downtime.
- **Irrigation Systems:** Long-lasting hydraulic pumps and pipelines used in agriculture.
- **Elevator and Lift Systems:** Hydraulic lifts with durable components that ensure reliable, continuous service.

6. Challenges in Hydraulic and Perennial Systems

While hydraulics and perennial systems offer numerous benefits, they also face some challenges:

- **Leakage and Contamination:** Hydraulic systems are prone to fluid leaks and contamination, which can reduce efficiency.
- **Wear and Tear:** Continuous operation can lead to gradual degradation of components.
- **Maintenance Requirements:** Although perennial systems are low-maintenance, they still require periodic inspections and servicing.

7. Conclusion

Hydraulics plays a vital role in mechanical systems by providing precise and powerful motion control. When combined with perennial engineering principles, hydraulic systems become highly reliable and durable, capable of long-term operation with minimal maintenance. Their efficiency, versatility, and ability to handle heavy loads make them indispensable in industries ranging from construction to manufacturing. Sustainable design, regular maintenance, and advancements in hydraulic technology continue to enhance their performance and longevity.

Chhotray Singh Bag,
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The Role of Civil Engineers in Current Society: Building the Foundation of Tomorrow

In the contemporary world, civil engineers play a pivotal role in shaping and sustaining society. From constructing towering skyscrapers and intricate bridges to developing water supply systems and resilient transportation networks, civil engineers are the architects of modern infrastructure. Their work directly impacts the quality of life, safety, and sustainability of communities, making them an integral force in societal progress.

1. The Backbone of Infrastructure Development

Civil engineers are responsible for designing and constructing the essential infrastructure that forms the foundation of society. Roads, highways, airports, and railways, which facilitate transportation and trade, are all products of their ingenuity. They also develop water supply and sewage systems that ensure the health and sanitation of the population. Their expertise is indispensable in urban planning, where they create organized, efficient, and sustainable cities.

2. Disaster Mitigation and Resilient Structures

As the frequency of natural disasters such as earthquakes, floods, and hurricanes increases, civil engineers play a vital role in disaster preparedness and resilience. They design structures that can withstand extreme conditions, minimizing damage and loss of life. By incorporating earthquake-resistant designs, flood management systems, and storm water drainage networks, they protect communities from catastrophic events.

3. Sustainable and Green Infrastructure

In the face of environmental challenges, civil engineers are at the forefront of promoting sustainability. They incorporate eco-friendly designs and materials, reduce carbon footprints, and develop energy-efficient buildings. Green infrastructure, such as rain gardens, permeable pavements, and solar-powered facilities, demonstrates how civil engineers contribute to combating climate change and conserving natural resources.

4. Smart Cities and Technological Integration

With the advent of smart technology, civil engineers are integrating advanced systems into urban development. Smart cities leverage data and technology to optimize traffic management, energy consumption, and public services. Civil engineers collaborate with software experts and urban planners to create interconnected, tech-driven societies that enhance the quality of urban life.

5. Ensuring Public Safety and Quality of Life

Public safety is a primary concern for civil engineers. Their designs prioritize structural stability, fire safety, and accessibility. Whether it is building safe roads with clear signage or constructing

earthquake-proof structures, their work ensures that public spaces are secure. Additionally, civil engineers contribute to recreational and public-use facilities, such as parks, stadiums, and community centers, promoting social well-being.

6. Economic Growth and Employment

Civil engineering projects are significant drivers of economic growth. Large-scale infrastructure developments generate employment opportunities and stimulate local economies. The construction of roads, bridges, airports, and industrial facilities encourages business investments, boosting economic activity.

7. Ethical Responsibility and Community Engagement

Modern civil engineers are increasingly aware of their ethical responsibilities. They engage with local communities, addressing their needs and concerns during project planning. Prioritizing ethical practices ensures that projects benefit society without exploiting resources or harming the environment.

Conclusion

The role of civil engineers in current society extends far beyond constructing buildings and roads. They are the visionaries and problem-solvers who shape the world around us, creating sustainable, safe, and functional environments. As technology advances and environmental challenges grow, civil engineers will continue to lead the way, building a future that balances progress with sustainability.

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Advanced Construction Technologies: Revolutionizing the Future of Building

The construction industry is undergoing a transformative shift with the integration of advanced technologies. From automated machinery and 3D printing to Building Information Modeling

(BIM) and sustainable materials, these innovations are reshaping how structures are designed, built, and maintained. Advanced construction technologies are not only enhancing efficiency and precision but also promoting sustainability and reducing costs.

✔ 1. Building Information Modelling (BIM)

Building Information Modeling (BIM) is a revolutionary technology that allows architects, engineers, and construction professionals to collaboratively design, visualize, and manage building projects in a digital environment.

- **3D modelling and visualization:** BIM enables the creation of detailed 3D models that represent the physical and functional characteristics of a building.
 - **Improved collaboration:** It enhances communication between stakeholders, reducing errors and rework.
 - **Lifecycle management:** BIM tracks the building's entire lifecycle, including maintenance and renovations, making it invaluable for facility management.
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☐ 2. 3D Printing in Construction

3D printing is transforming construction by enabling the rapid and cost-effective production of building components.

- **Faster construction:** Entire houses and structures can be 3D printed in a matter of days, significantly reducing construction time.
 - **Cost-effective and sustainable:** It minimizes material waste and uses recycled materials, making it an eco-friendly technology.
 - **Customization and complexity:** 3D printing allows for the creation of complex and customized designs that would be difficult or costly with traditional methods.
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✂☐ 3. Robotics and Automation

Automation and robotics are streamlining construction processes, improving safety, and boosting productivity.

- **Automated machinery:** Robots are being used for bricklaying, concrete pouring, and welding, reducing labour-intensive tasks.
 - **Drones for surveying:** Drones provide real-time data collection, helping with site surveys, mapping, and progress monitoring.
 - **Improved safety:** Robotic systems can perform dangerous tasks, reducing risks for human workers.
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⚙☐ 4. Prefabrication and Modular Construction

Prefabrication and modular construction involve assembling building components off-site and transporting them for final installation.

- **Faster project completion:** Prefabricated modules reduce on-site labor requirements and speed up construction timelines.
 - **Cost and waste reduction:** Factory-controlled conditions ensure precision, minimizing material waste.
 - **Enhanced quality control:** Modular construction offers higher quality standards due to consistent manufacturing processes.
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✿ 5. Sustainable and Smart Materials

The use of innovative materials is transforming the construction industry by enhancing durability, reducing costs, and promoting sustainability.

- **Self-healing concrete:** This material repairs its own cracks, improving structural longevity and reducing maintenance costs.
 - **Aerogel insulation:** Known for its exceptional thermal insulation properties, aerogel is used to improve building energy efficiency.
 - **Smart glass:** Also known as electrochromic glass, it adjusts transparency based on temperature and light, optimizing energy use.
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🤖 6. Artificial Intelligence (AI) and Machine Learning

AI and machine learning are being used to optimize construction planning and decision-making.

- **Predictive analytics:** AI analyzes historical data to forecast project risks, preventing delays and cost overruns.
 - **Automated scheduling:** Machine learning algorithms optimize construction schedules, improving efficiency.
 - **Quality control:** AI-powered systems monitor construction sites, detecting errors and ensuring compliance with standards.
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🌐 7. Internet of Things (IoT) and Smart Construction

IoT enables real-time data collection and monitoring, enhancing the efficiency and safety of construction sites.

- **Smart sensors:** IoT devices monitor temperature, humidity, and equipment performance, ensuring optimal working conditions.
 - **Wearable technology:** Smart helmets and vests track worker movements, improving safety and productivity.
 - **Remote site management:** IoT allows managers to remotely monitor construction sites, reducing the need for on-site supervision.
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👓 8. Augmented Reality (AR) and Virtual Reality (VR)

AR and VR are transforming the design and construction processes by providing immersive and interactive experiences.

- **Design visualization:** AR allows stakeholders to visualize structures in real-world settings before construction begins.
- **Training and safety:** VR is used for safety training, simulating hazardous environments for practice without real-world risks.
- **On-site assistance:** AR enables real-time guidance and information overlay during construction tasks.

✓ 9. Digital Twins in Construction

Digital twins are virtual replicas of physical structures that provide real-time data throughout the building's lifecycle.

- **Real-time monitoring:** Sensors embedded in buildings continuously update the digital twin, offering insights into performance and maintenance needs.
- **Efficient facility management:** It enhances predictive maintenance and operational efficiency.
- **Cost savings:** Early detection of issues reduces repair costs and prevents unexpected failures.

🌍 10. Green Construction Technologies

The adoption of green technologies is making construction more sustainable and environmentally friendly.

- **Energy-efficient designs:** Passive design strategies and energy-efficient systems reduce the carbon footprint of buildings.
- **Renewable energy integration:** Solar panels, wind turbines, and geothermal systems are increasingly used in modern construction.
- **Recycled and eco-friendly materials:** The use of recycled concrete, bamboo, and sustainable wood is reducing construction waste.

✂️ Conclusion

Advanced construction technologies are driving the industry toward a more efficient, sustainable, and innovative future. By adopting automation, AI, robotics, and sustainable practices, the construction sector is becoming faster, safer, and more cost-effective. These advancements are not only enhancing the quality of buildings but also transforming the overall construction process, paving the way for smarter, greener, and more resilient infrastructure.

Gudly Naik,

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The Role of Bearings in Green Technology: Enhancing Efficiency and Sustainability

Bearings play a vital role in the advancement of green technology, serving as essential components in machinery, renewable energy systems, and energy-efficient devices. By reducing friction, enhancing performance, and enabling smooth motion, bearings contribute significantly to

the efficiency and longevity of sustainable technologies. As the world moves toward greener energy solutions, innovative bearing designs are helping reduce energy consumption, minimize waste, and promote eco-friendly practices.

✓ 1. Bearings in Renewable Energy Systems

Bearings are integral to the efficient functioning of renewable energy systems, such as wind turbines, solar panels, and hydroelectric plants.

- **Wind turbines:** Bearings reduce friction and enable the smooth rotation of turbine blades, maximizing energy capture. Main shaft bearings, generator bearings, and pitch bearings ensure stability and reliability in high-load conditions. Low-friction and self-lubricating bearings reduce energy losses, enhancing the overall efficiency of wind farms.
 - **Solar tracking systems:** Solar panels use bearings in their tracking systems to follow the sun's movement, increasing exposure and optimizing energy output. Precision bearings allow for accurate and reliable solar tracking, boosting efficiency.
 - **Hydroelectric plants:** Bearings in hydro turbines facilitate the smooth operation of rotating shafts, reducing wear and enhancing the performance of water-driven generators.
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⚙️ 2. Improving Energy Efficiency

Energy efficiency is a cornerstone of green technology, and bearings play a key role in reducing energy consumption across various industries.

- **Low-friction bearings:** Advanced bearing designs reduce frictional losses, improving the efficiency of industrial machinery and transportation systems.
- **Energy-efficient electric motors:** Bearings with lower torque improve the performance of electric motors used in electric vehicles (EVs) and industrial applications. This results in lower energy consumption and increased range for EVs.
- **Reduced maintenance and downtime:** Bearings with enhanced durability and self-lubricating properties minimize the need for frequent maintenance, reducing resource waste and operational costs.

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Fluid Power Systems: Hydraulic and Pneumatic Advances

Fluid power systems, encompassing hydraulics and pneumatics, play a critical role in modern engineering and industrial applications. These systems harness the power of pressurized fluids (liquids in hydraulics and gases in pneumatics) to generate motion, control, and force. With ongoing technological advancements, fluid power systems are becoming more efficient, reliable,

and eco-friendly, driving innovation across industries such as manufacturing, transportation, construction, and renewable energy.

✓ 1. Hydraulic Systems: Precision and Power

Hydraulic systems use pressurized liquid, typically oil, to transmit power. They are known for their high force capabilities, making them ideal for heavy-duty applications.

- **High power-to-weight ratio:** Hydraulics deliver significant force with compact components, making them essential in construction equipment, cranes, and heavy machinery.
 - **Precise control:** Modern hydraulic systems use advanced servo and proportional valves, enabling precise motion control in industrial automation and robotics.
 - **Efficiency improvements:** New hydraulic designs incorporate variable-speed pump drives and energy recovery systems to reduce power consumption and increase efficiency.
 - **Eco-friendly hydraulic fluids:** The adoption of biodegradable hydraulic oils reduces environmental impact, making hydraulic systems more sustainable.
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⚙️ 2. Pneumatic Systems: Speed and Simplicity

Pneumatic systems utilize compressed air or inert gases to generate force and motion. Known for their speed and simplicity, they are widely used in manufacturing, packaging, and automation.

- **Lightweight and cost-effective:** Pneumatic systems are typically lighter and less expensive than hydraulic counterparts, making them suitable for small-scale and high-speed applications.
 - **Rapid response and reliability:** Pneumatic actuators offer fast cycling times, making them ideal for high-speed automation tasks.
 - **Energy-efficient designs:** New pneumatic systems incorporate energy recovery mechanisms and low-leakage seals, improving efficiency and reducing air consumption.
 - **Smart pneumatics:** Integration with IoT and data analytics allows real-time monitoring of pneumatic systems, optimizing performance and minimizing downtime.
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🔧 3. Advances in Fluid Power Technology

Technological innovations are transforming fluid power systems, making them smarter, more efficient, and environmentally friendly.

- **Electro-hydraulic and electro-pneumatic systems:** Hybrid systems that combine fluid power with electrical control offer enhanced precision and flexibility. These systems are increasingly used in mobile machinery and industrial automation.
- **Smart sensors and IoT integration:** Sensors in hydraulic and pneumatic systems monitor pressure, temperature, and flow rates in real time, enabling predictive maintenance and reducing downtime.
- **Proportional and servo control:** Advanced control systems allow precise modulation of pressure and flow, improving the accuracy and efficiency of fluid power applications.
- **Compact and lightweight designs:** Modern fluid power components are becoming smaller and more efficient, improving space utilization and energy efficiency.

✿ 4. Energy Efficiency and Sustainability

As industries prioritize sustainability, fluid power systems are being designed with energy efficiency in mind.

- **Energy-efficient hydraulic pumps:** Variable-speed and load-sensing pumps reduce energy consumption by adjusting power output according to the system's demand.
 - **Low-leakage pneumatic systems:** Improved sealing technologies reduce air leaks, enhancing the efficiency and sustainability of pneumatic systems.
 - **Regenerative systems:** Hydraulic energy recovery systems capture and reuse excess energy, reducing waste and improving overall efficiency.
 - **Use of eco-friendly fluids:** The adoption of non-toxic and biodegradable hydraulic fluids reduces environmental contamination.
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✈ 5. Applications of Advanced Fluid Power Systems

Modern hydraulic and pneumatic technologies are enhancing performance and reliability in various industries:

- **Construction and agriculture:** Hydraulic systems power excavators, loaders, and tractors, providing the strength required for heavy-duty operations.
 - **Manufacturing and automation:** Pneumatic actuators and grippers enable high-speed material handling, packaging, and assembly operations.
 - **Automotive and aerospace:** Advanced fluid power systems are used in braking, steering, and suspension systems, improving vehicle safety and performance.
 - **Renewable energy:** Hydraulics play a key role in wind turbines and hydroelectric plants, optimizing energy generation efficiency.
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✓ 6. Safety and Reliability Improvements

Advances in fluid power technology are enhancing safety and reliability in industrial applications.

- **Fail-safe mechanisms:** Modern hydraulic and pneumatic systems include fail-safe designs to prevent accidents in case of pressure loss or system failure.
 - **Enhanced sealing technology:** Improved seals and gaskets minimize leaks, reducing maintenance requirements and extending system longevity.
 - **Real-time diagnostics:** Smart fluid power systems with integrated diagnostics detect faults early, preventing costly breakdowns and improving operational safety.
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🌐 7. The Future of Fluid Power Systems

The future of fluid power lies in greater automation, digitalization, and sustainability.

- **Electro-fluid power hybrids:** The combination of electrical and fluid power systems will enhance precision and flexibility.

- **Artificial intelligence and machine learning:** AI will optimize fluid power system performance by analyzing real-time data and predicting maintenance needs.
 - **Energy recovery and reuse:** Regenerative fluid power systems will become more common, improving efficiency and reducing waste.
 - **Green fluid power:** The adoption of renewable energy-powered hydraulic and pneumatic systems will contribute to greener and more sustainable industrial operations.
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✿ Conclusion

Fluid power systems, through hydraulic and pneumatic advances, are evolving to become smarter, more efficient, and environmentally friendly. Their role in modern industry is expanding with the integration of IoT, predictive maintenance, and energy-efficient technologies. As fluid power systems continue to advance, they will drive innovation in various sectors, contributing to enhanced performance, reliability, and sustainability across industries.

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Renewable Dreams: The Art of Civil Engineering

Beneath the sun's relentless flame,
Where winds and waters call by name,
The hands of progress, firm and wise,
Build futures under endless skies.

Upon the earth, with steady hands,
Civil engineers shape the lands,
They tame the tides, they raise the hills,
With concrete dreams and iron wills.

The turbines spin with gentle grace,
As winds weave currents through their face,
Their blades, like dancers, sweep the air,
And power flows from whispered prayer.
On distant plains where tall they rise,
They catch the breath of boundless skies.

And in the seas where currents sway,
The ocean's pulse, both night and day,
Is channeled through the careful schemes
Of minds that weave the wildest dreams.
Tidal fences, strong and sure,
Harness waters, clear and pure.

The sun, a golden crown on high,
Sends light to greet each newborn sky.
With panels wide on roofs they lay,
Civil hands draw down its ray.
Through copper veins, the currents flow,
And light fills homes in steady glow.

Geothermal veins, the earth's own heat,
Surge forth from caverns deep beneath.
Through careful pipes, their power steams,
To light up towns and drive machines.
The earth, both quiet and profound,
Now yields its fire from underground.

The dams in rivers, tall and strong,
Resist the water's endless song.
With graceful might, they hold the streams,
And turn their rage into machines.
The wheels of power hum and sing,
As flowing life makes turbines spin.

And on the highways, free and fleet,
The hum of silent cars repeat.
Electric veins, so finely laid,
Where engineers their art displayed.
The fuel of yore, now cast aside,
As sun and wind and waves provide.

O civil minds, with steady art,
You build the roads, you shape the heart
Of cities bold with towers tall,
And bridges where the rivers call.

But now, with wisdom, soft and kind,
You cradle Earth, no chains to bind.

You tame the storm, but not the sea,
You guide the sun, but let it free,
You lift the world with gentle hand,
And shape anew the sacred land.
For with each brick, each beam you raise,
You build a greener, kinder phase.

So let the winds of progress blow,
And let the rivers freely flow.
With civil craft and nature's grace,
We build a brighter, greener place.
Where human hands and earth's own song,
In perfect harmony belong. ❁

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Noise, Vibration, and Harshness (NVH): An Essential Aspect of Engineering Design

Noise, Vibration, and Harshness (NVH) is a critical field in engineering that deals with the study, analysis, and control of unwanted sound, vibrations, and the overall tactile or auditory discomfort experienced in vehicles, machinery, and structures. In industries such as automotive, aerospace, construction, and manufacturing, managing NVH is essential for improving performance, comfort, safety, and product longevity.

✓ 1. Understanding NVH Components

NVH encompasses three interconnected phenomena:

- **Noise:** Refers to unwanted sound generated by mechanical, electrical, or aerodynamic sources. It can be airborne (traveling through the air) or structure-borne (transmitted through solid materials).
 - **Vibration:** Mechanical oscillations caused by moving parts or external forces. Vibrations can lead to discomfort, fatigue, and even damage to structures or components.
 - **Harshness:** A subjective term that describes the discomfort or roughness felt due to sudden or severe vibrations. It reflects the quality of the ride or experience in vehicles and machinery.
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🔧 2. Sources of NVH in Engineering

NVH issues arise from various sources, which can be categorized into mechanical, aerodynamic, and structural origins.

- **Mechanical sources:** Rotating and moving parts, such as engines, gears, fans, and pumps, generate vibrations and noise due to imbalances, misalignment, or friction.
 - **Aerodynamic sources:** Airflow around a vehicle or structure creates turbulence and noise. Wind resistance and drag contribute to NVH, particularly at higher speeds.
 - **Structural sources:** Resonance or flexing of components can amplify vibrations and noise. For instance, in buildings, vibrating HVAC systems can generate unpleasant noise levels.
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⚙️ 3. Importance of NVH in Automotive Engineering

In the automotive industry, NVH control is a key factor in vehicle design, directly influencing passenger comfort and overall performance.

- **Cabin comfort:** Reducing noise from the engine, tires, and road surfaces enhances passenger experience.
- **Ride quality:** Lower vibrations and smoother handling reduce fatigue for drivers and passengers.
- **Structural integrity:** Controlling vibrations prevents premature wear and tear of vehicle components, improving durability.
- **Electrification challenges:** Electric vehicles (EVs) produce less noise from the powertrain but reveal new NVH issues, such as tire and wind noise, which become more noticeable in the absence of engine sounds.

⚙️ 4. NVH in Civil Engineering and Construction

NVH is also a major consideration in civil engineering, where it affects building performance and occupant comfort.

- **Structural vibrations:** Vibrations from machinery, vehicles, or seismic activity can affect building stability and comfort.
- **Noise pollution:** Construction equipment and traffic can generate high noise levels, requiring effective noise control measures.

- **Soundproofing and damping:** Engineers use insulation materials, acoustic panels, and dampers to reduce NVH in buildings and infrastructure.
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✿ 5. NVH in Aerospace and Machinery

In aerospace and industrial machinery, NVH control is crucial for safety, performance, and reliability.

- **Aerospace:** Reducing vibrations and cabin noise enhances passenger comfort in aircraft. It also prevents mechanical fatigue in sensitive aerospace components.
 - **Industrial machinery:** Excessive vibrations in rotating equipment, such as turbines and compressors, can lead to inefficiencies, malfunctions, and costly repairs.
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🔧 6. NVH Testing and Analysis Techniques

Accurate testing and analysis are essential for identifying and mitigating NVH issues.

- **Modal analysis:** Measures the natural frequencies of components to prevent resonance and minimize vibrations.
 - **Sound level meters and microphones:** Measure airborne noise levels and identify sources of unwanted sound.
 - **Accelerometers and vibration sensors:** Detect vibrations in rotating or moving machinery, helping engineers pinpoint sources of mechanical noise.
 - **Finite element analysis (FEA):** Simulates and predicts NVH behavior during the design phase, reducing the need for physical prototypes.
 - **Noise mapping:** Visual representation of noise levels across a structure or system, helping engineers design better soundproofing solutions.
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🔧 7. NVH Reduction Techniques

Engineers use a variety of methods to minimize NVH, including:

- **Damping materials:** Viscoelastic materials absorb and dissipate vibrations, reducing structural noise.
 - **Acoustic insulation:** Sound-absorbing materials, such as foam and composites, reduce airborne noise in vehicles and buildings.
 - **Vibration isolators and mounts:** Rubber or elastomeric mounts isolate vibrating components from the frame, reducing noise and harshness.
 - **Active noise cancellation (ANC):** In vehicles and industrial machinery, ANC systems use microphones and speakers to generate sound waves that counteract unwanted noise.
 - **Aerodynamic design:** In automotive and aerospace engineering, streamlined shapes reduce wind noise and drag.
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✿ 8. NVH in Sustainable and Green Technologies

As sustainability becomes a priority, NVH engineers are focusing on reducing noise pollution and enhancing energy efficiency.

- **Quieter EVs and hybrid vehicles:** Electric motors produce less noise, but NVH control focuses on tire and aerodynamic noise. Artificial sound generation is also used for pedestrian safety.
- **Eco-friendly construction materials:** Noise-absorbing and vibration-damping materials made from recycled or sustainable materials are gaining popularity.
- **Energy-efficient HVAC systems:** NVH-optimized systems reduce noise and improve energy efficiency in buildings.

🌐 9. The Future of NVH Engineering

The future of NVH engineering will be driven by technological advancements and changing industry needs.

- **Artificial intelligence (AI) and machine learning:** AI-powered NVH analysis will improve the accuracy of noise and vibration predictions, enhancing product design and testing.
- **Smart materials:** The use of shape-memory alloys and active damping systems will provide real-time NVH control.
- **Digital twins:** Virtual replicas of physical systems will allow real-time NVH monitoring, enabling predictive maintenance and performance optimization.
- **Sustainable noise control:** With stricter noise regulations, NVH engineering will focus on environmentally friendly soundproofing and vibration-damping solutions.

✓ Conclusion

Noise, Vibration, and Harshness (NVH) engineering is a critical field that enhances the comfort, safety, and efficiency of vehicles, machinery, and infrastructure. By employing advanced materials, sophisticated analysis techniques, and innovative solutions, engineers can mitigate NVH issues, creating quieter, smoother, and more reliable products. As technology evolves, NVH engineering will continue to play a vital role in shaping modern industry, promoting sustainability, and improving overall quality of life.

Monalisa Naik,
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Whispers of the Sun: A Poem on Renewable Energy Systems

The sun, a golden sovereign high,
Pours warmth across the morning sky,
And with its rays, so pure, so bright,
It plants the seeds of endless light.
No coal, no flame, no ash, no scar,
Just gentle beams from distant star.

The winds, with fingers swift and free,
Caress the plains and kiss the sea.
They spin the blades on slender spires,
And turn their breath to living fires.

No engines hum, no fuel is burned,
Just airy hands by turbines turned.

The rivers race with tireless force,
A ceaseless, ever-pounding course.
Through dams, they surge in channelled might,
And power flows from falling white.
No smoky haze, no bitter flame,
Just waters whispering power's name.

The earth, a furnace, deep and vast,
Holds heat from ages long since passed.
Through cracks and stone, its warmth ascends,
And through the pipes, its power bends.
No oil to spill, no gas to burn,
Just steady heat from earth's own churn.

And in the skies, with silent grace,
The sun's own face we now embrace.
With solar wings, we seek its gleam,
To fuel the hope of mankind's dream.
No weary wells, no fading store,
Just light that shines forevermore.

O minds of steel and hearts of flame,
Who bend the sun and call its name,
You draw the winds and waters wide,
To build a future side by side.
Where engines hum with gentler song,
And human hands no more do wrong.

Let turbines turn, let rivers run,
Let solar fields drink in the sun.
Let future voices rise and sing,
Of boundless hope on gentle wing.
For in the dance of sun and sea,
We find our new eternity. ❀

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Art Section

👋 Welcome to the Art Section of our Departmental magazine! ✍️

Art is not just about colors on a canvas or lines on a page; it's about expressing the depths of our imagination, emotions, and perspectives. In this section, we celebrate creativity in its myriad forms – from traditional paintings to digital art, from sculpture to photography, and everything in between.

Through the strokes of our brushes, the clicks of our cameras, and the chiseling of our sculptures, we aim to captivate, inspire, and provoke thought. Each piece featured here tells a story, reflects a moment, or expresses an idea unique to its creator.

Art has the power to transcend boundaries, ignite conversations, and evoke profound emotions. So, immerse yourself in the world of creativity, let your imagination roam free, and join us on a journey through the boundless realms of artistic expression.

We invite you to explore, appreciate, and engage with the works showcased in this section. Let the colors, shapes, and textures speak to you, and may they inspire you to discover your own artistic voice.

Enjoy the journey!!!!

Relationship Teacher and Student.

A teacher must always motivate and inspire her students.
My teacher was Favorite because she has taught us the right thing in our life in the correct ways.
She has always appreciated our efforts in Learning.
She is a very kind person but a strict one too she has taught us the basic principles for which we are student so grateful.
Here lovely yet caring me to be Formal and disciplined.
The teacher students develop growth mindset through praising effort setting learning goals and creating a safe environment.
She come to college every day she guide her.
Her lovely yet caring personality comfort her student.
The teacher mercy student life is like a blessing from god.
Teacher helps the student to set the learning objects and aim to find new discoveries.
The building block of strong teacher student relationship is effective communication.
This is a student's life begins in an institution and his life in a regional institution is difficult and so it is very sad that a teacher is a speaking god.
Remember nothing is impossible for you.
You can do.
What you never thought.
His life is one and time also limited so live life and time are best teacher.
Life teacher as the use time and time teacher as the value of life.
To the world you may be but.
to your students you are a hero....
Without teacher who is cannot achieve the education and Every great dream being with a dreamer....
Every teacher once was a student's every learner once was a loser.
but all of them crossed
The bridge called 'Learning'

Name - Bichha Madi
Branch - Civil

Bichha Madi

**5th Sem.
Diploma, CE**

“Always keep smiling ..”

ଜୟ ଜଗନ୍ନାଥ

ଅନାଥ ର ନାଥ ଆହେ ଜଗନ୍ନାଥ

ଜଗତେ ବଡ଼ ଠାକୁର

ତୁମେ ପରଂବ୍ରହ୍ମ ଦୟାର ଠାକୁର

ମୋ ଠାରେ ସୁଦୟା କର ।।

ତୁମରି ଆଶୀଷ ପାଇବା ପାଇଁକି

ଭକ୍ତ ବୁଲେ ତ୍ରିଭୁବନ

ଶରଧାବାଲିରେ ଅତି ଶରଧାରେ

କରିଲ ତୁମ ଦର୍ଶନ ।।

ଷାଠିଏ ପଉଟି ଭୋଗ ଲାଖ୍ ହୁଏ

ପ୍ରତିଦିନେ ତୁମ ଠାରେ

ମହା ପ୍ରସାଦ

କୁ ଶ୍ରଦ୍ଧାଳୁ ଭକତେ

ପାଇଥାନ୍ତି ସରାଗରେ ।।

ଶ୍ରୀକ୍ଷେତ୍ର ଧାମରେ ବଡ଼ ଦେଉଳ ରେ

ସ୍ବାମୀ ହୋଇ ବସିଅଛ

ଜଗତର ନାଥ ଆହେ ଜଗନ୍ନାଥ

ଲୀଳା ତୁମେ କରୁଅଛ ।।

ନୀଳାଦ୍ରି ବିହାରୀ ଆହେ ଭାବଗ୍ରାହୀ

ତୁମ ଠାରେ ଅଳି ମୋର

କରୋନା ରାକ୍ଷସ ଗ୍ରାସୀ ବସିଅଛି

ସମୂଳେ ବିନାଶ କର ।।

୦||୦

Biswabharati Naik,
Assistant professor
(civil engineering)

Improving Pavement Quality Using Recycled Materials

The use of recycled materials such as RAP, recycled rubber, and RCA in pavement construction presents a promising approach to both improving pavement quality and promoting environmental sustainability. These materials not only reduce the demand for virgin resources but also enhance the durability, flexibility, and overall performance of pavements. Despite the existing challenges, including variability in material quality and processing complexities, the integration of recycled materials into road construction has the potential to become a standard practice in the near future.

MY INDIA

Bombay for Beauty

Delhi for Majesty

Bengal for Writing

Punjab for wrestling

Kashmir for Looking

Madras for Cooking

Gujarat for Health

M.P. for Wealth

A.P. for Hard working

Maharashtra for Learning

Kerala for Dance

Mysore for Glance

Bihar for Mines

Himachal for Pines

Up for Ministers

Rajasthan for Heroism

Nagaland for Hills

Assam for Wells

Uttaranchal for Toil

Odisha for Soil

This is my INDIA Gracious, Glorious, Royal

SAVE WATER SAVE LIFE



Name - Kumudini Bery, Kentumani Nag, Sanjukta Mehanam, Mithila Pujhary
Branch - CIVIL

SAVE
WATER
SAVE
LIFE

NO
WATER
NO
LIFE



Nome- Rujabul majhi

SAVE ENVIRONMENT



Name - Umila majhi Branch - civil

*** Winter Season ***



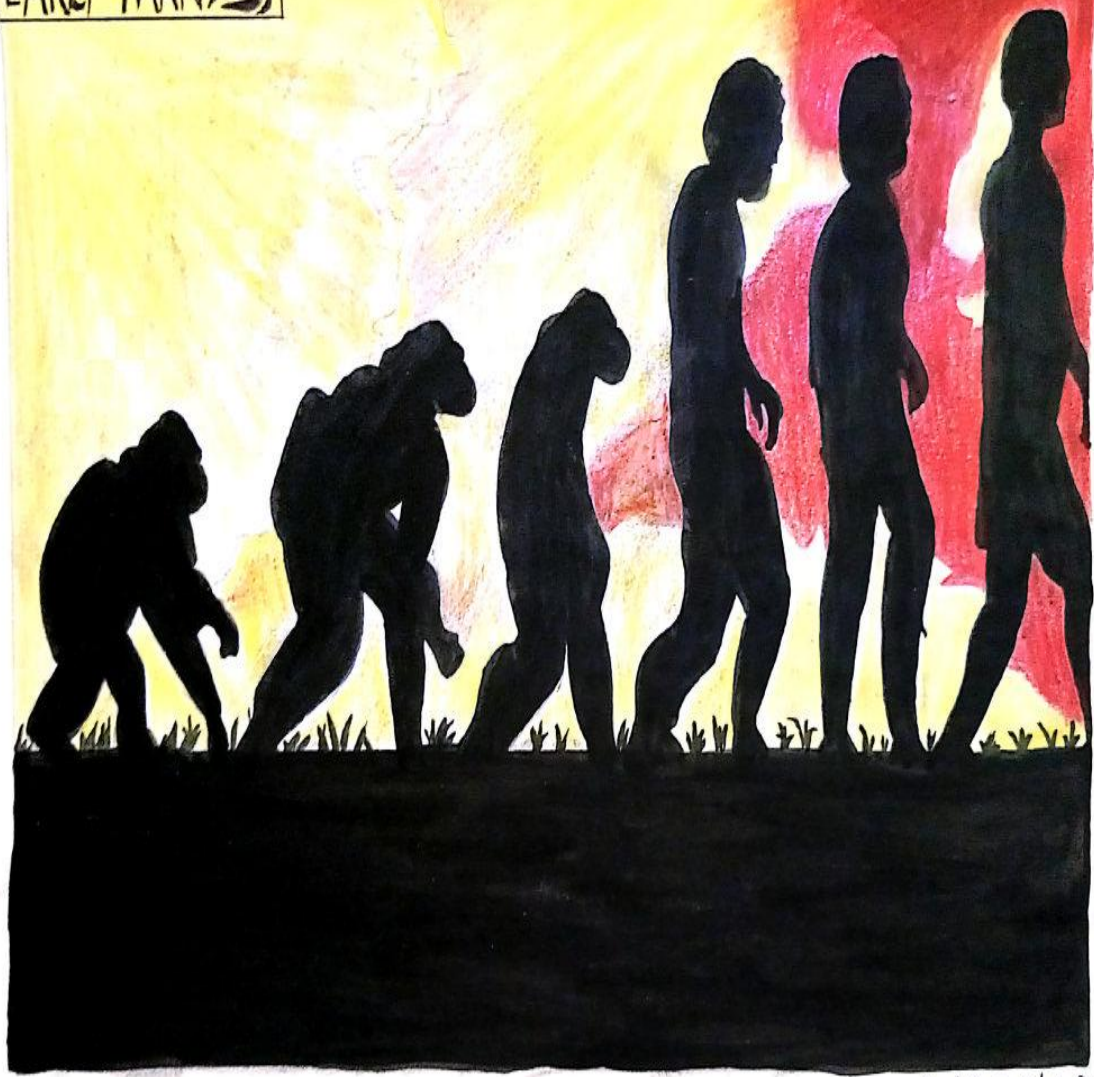
NAME - Mithila Pujhara, Sanjiv Kumar, Kantavari Narg, Kumudini Bary Branch - CIVIL



3rd Semester - Diploma
Kajalini Madahe



EARLY MAN



3rd Semester-Diploma
Kailasini Pradhan

Save Them...
Respect Them...
Protect them...

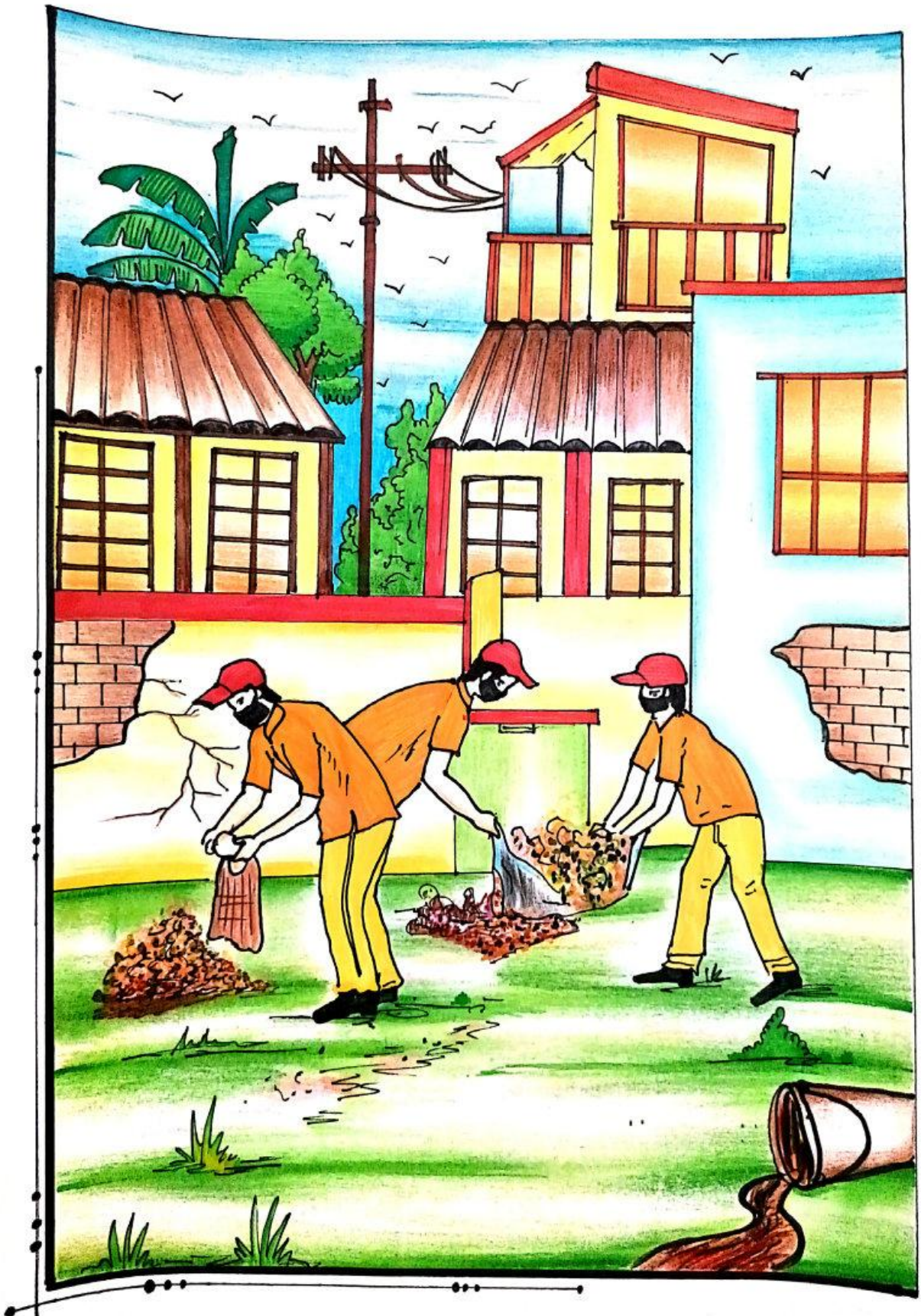
STOP

ASSUALT



SIMCO
CSE





HOW TO STOP GLOBAL WARMING :-

The environment as of now causes everyone to be in trouble. To stop the global warming citizens should learn how to reduce the use of plastic, plant more trees, and consume energy more wisely. First, global warming means the increase of the temperature of the earth's atmosphere. Therefore, by using less plastic, citizens could alleviate to the eco-system disruption. plastic are very durable cheap, and can even last for a lifetime. But over the years, a lot of things are changing just because of plastic. Many sea turtles have died since they have eaten plastic bags because they thought it was a jellyfish that they could eat. Not only the animals in the world are being affected, but also mother nature itself. citizens should know when and how to use plastic bags in a proper manner. As for myself, as much as possible, I help to minimize plastic polluting by using metal straws, spoons, and forks. I bring them every day with me so whenever I go out get food, I do not have to ask for disposable plastic utensils to help save the environmental. Bringing our own eco bag or what we call reusable grocery bags every time time we shop or do some groceries will stop the destruction of our eco-system.

The three R's means reduce, reuse, recycle. Every product that we use has a label if it can be reused or recycled. Reduce means reducing the products that people should buy and avoiding the products with too much packaging. All these plastic can last for a lifetime and may affect the environment. Secondly, recycling is where reuse things that are reusable and do not easily break. Lastly, recycle. There are a lot of kinds of stuff that citizens could recycle, like, paper, cans, plastic, and glass. It could make new things like toys or even cloths. It would reduce almost fifty percent of the material that can all go to waste. We should look for items that can be recycled instead of the items that cannot be used anymore because it can save more money and could be much more convenient. Therefore, by using fewer plastic, citizens could help the world be a better place to live in. As our climate changes and causes global warming, we citizen plant more trees around the world. As well all know, trees absorb carbon dioxide from the air and release oxygen into the atmosphere. Around my community, I was worried when I saw that all the trees and plants are cut down because they were building more houses around the area. I cannot imagine how many trees were lost. We can get flooding in the area because of all the trees that were cut down.

Stephen Raita -

NATURE :-

Everything we see around us, right from the moment we step outside our home is part of nature. The trees, animals, landscape, flowers, trees, breeze, sunlight, everything that makes our surroundings so beautiful and mesmerizing are part of nature. Nature does not arise spontaneously but needs years and years to bloom and blossom.

According to researches, nature we see today has developed in 4.5 billion years. Initially, the earth was not sustainable for any kind of living thing. The atmosphere had no to very little oxygen, and the same was the case with water. The land made of molten magma and the atmosphere was toxic to survive slowly. The earth cooled down, and life started blooming on it. It began to rain and nature, as we see today, was formed. This nature then gifted the earth with living creatures like animals, birds, and finally, humans.

It is the mother Nature who never harm us but always nurtures us. By providing us fruits and vegetables, it nurtures our body. By providing us water hydrates our body, and by providing oxygen. It cleanses our body. It is usually seen that people who live close to nature, especially the villagers live a somewhat happy life as compared to the people living amidst the high hovering skyscrapers. Nature provides our ears sweet sound of birds, rejuvenates us with fresh air, breeze fills our soul with joy, and inspires to flow like the river. Nature provides the raw material for economic development as well.

Unfortunately, humans today are polluting nature in such a way that the healing pace has fallen slowly. The use of plastic, emission of CO_2 , production of industrial waste, increased use of chemicals, deforestation, poaching, and oil spillage in water bodies are serious concerns today. These are not only polluting nature and are also degrading the quality of the environment needed for the survival of not only animals and birds but also humans.

Nature has inspired not only poets and writers but also the common man. All the great poets and writers like William Wordsworth have always given the nature a significant space in their writings and musings. Nature has the power to take us to the place of peace and imagination to free the emotions that been locked inside us. If those emotions and feelings get freed, then there is immense power in them to bring on the changes that are unexpected. Many people are currently working and getting linked with the nature conservation organization to preserve and enhance the nature and beauty around us.

Stephen Raita.

CAPITAL ENGINEERING COLLEGE

ସ୍ୱନାତ୍ ପାଠିକରୁ ଯଦି ବୈଷୟିକ ଶିକ୍ଷା ଅନୁଷ୍ଠାନଟି ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

୨୮ଟି ଗ୍ରାମ୍ୟ ମଧ୍ୟରୁ ଓଡ଼ିଶା ଗ୍ରାମ୍ୟରେ ଅବସ୍ଥିତ ଯଦି ଅନୁଷ୍ଠାନଟି
ଖୋର୍ଦ୍ଧା, ଭୁବନେଶ୍ୱର କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ମହିତମୟଟି ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

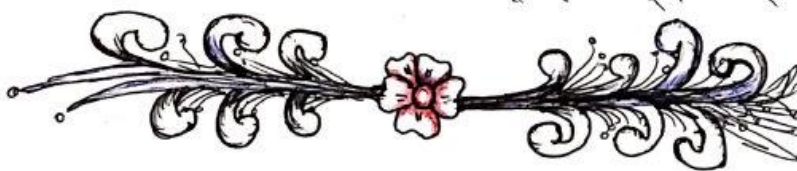
ସବୁ ପ୍ରକାର ଶିକ୍ଷା ଦିତ ଯଦି ଅନୁଷ୍ଠାନଟି ।
ଆସନ୍ତୁ ସମସ୍ତେ ନିର୍ଦ୍ଦେଶିତ ପଦକ୍ଷେପ କରୁନା ଶିକ୍ଷାଟି ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

ଦୁଇ ଦୁଇ ପ୍ରକାର ବୈଷୟିକ ଶିକ୍ଷା ମିଳେ ଯଦି ଅନୁଷ୍ଠାନଟି ।
ମିଳେ ଉଚ୍ଚା ଅନୁଷ୍ଠାନର ଶିକ୍ଷା ହାସଲ କରୁଥିବା ଛାତ୍ରଛାତ୍ରୀ ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

ଦୂର ଦୂର ଦିଗରୁ ଛାତ୍ରଛାତ୍ରୀ ଆସନ୍ତୁ ଯଦି ଅନୁଷ୍ଠାନଟି ।
ଶିକ୍ଷା ସମାପ୍ତ କରି ଯେଉଁ ନାଥାସ୍ତି ଛାତ୍ରଛାତ୍ରୀ ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

ଦୁଇ ଦୁଇ ଭାଷାର ଛାତ୍ରଛାତ୍ରୀ ଅଛନ୍ତି ଯଦି ଅନୁଷ୍ଠାନଟି
ଦେଶଭାଷା କିଛି ନାହିଁ ଆମ ଦିଗରେ ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।

ଆହାତ କି ସ୍ତମ୍ଭ ଯଦି ଅନୁଷ୍ଠାନଟି ଶାନ୍ତ ଗରିବଜୀବନ
ମନ କହୁଛି ସେଇ ଯେମିତି ଅନୁଷ୍ଠାନ ଯୁଦ୍ଧେ ଯିବା ଏକ ମହିତମୟ ।
କ୍ୟାପିଟାଲ୍ ଇଞ୍ଜିନିୟରିଂ କଲେଜ୍ ବୋଲି ତାହା ନାଥାଟି ।



Name - Gyanesh Maiti
Diploma - 5th Sem
Branch - Civil