



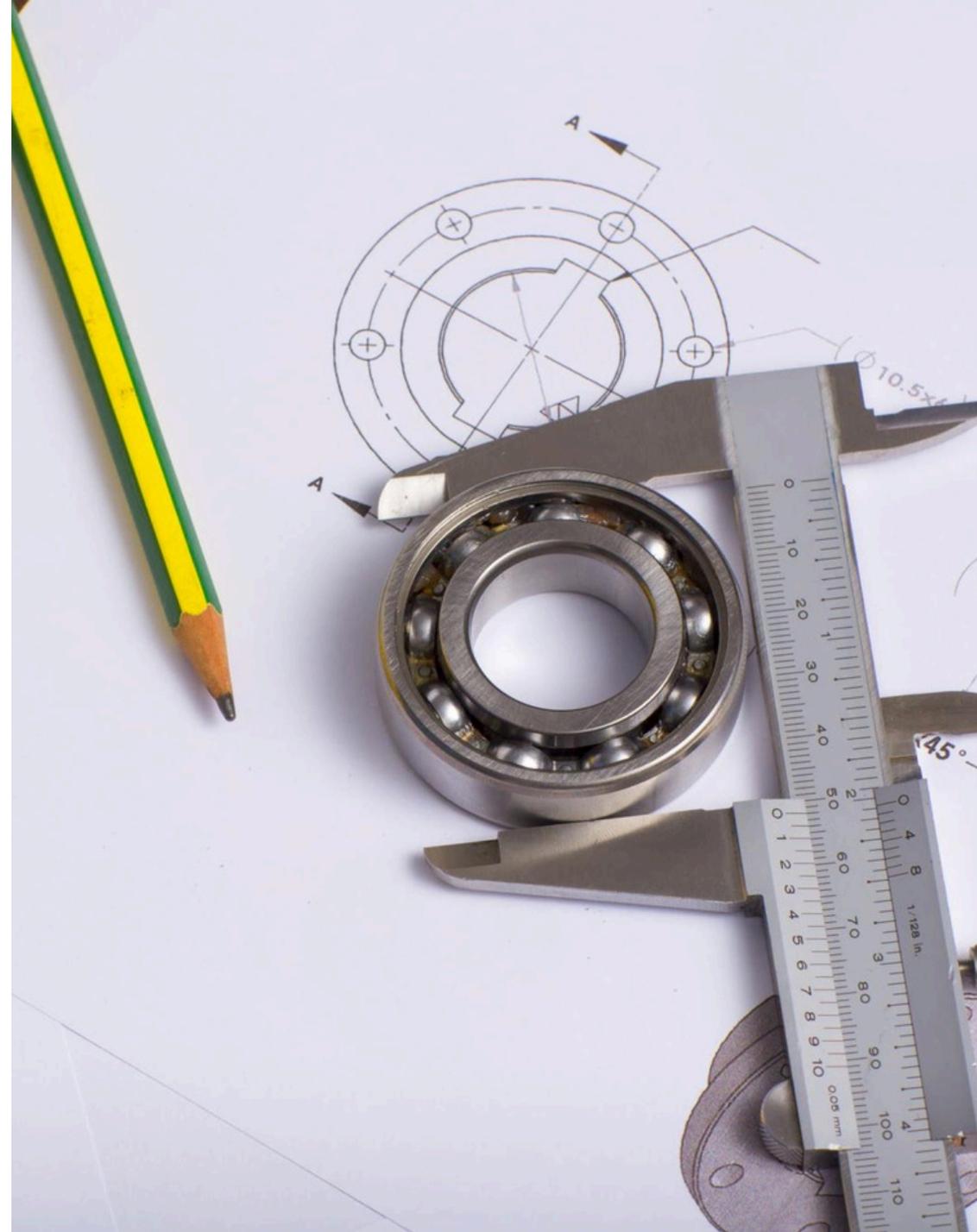
# **INTRODUCTION TO MECHANICAL ENGINEERING**

# What is Mechanical Engineering?

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Before entering into the Mechanical Engineer role, let us first understand the concept of Mechanical Engineering.

Mechanical Engineering is defined as the branch of engineering that deals with the design, development, construction, and operation of mechanical systems and tools. It includes machines, tools, and equipment used in various industries, such as transportation, manufacturing, power generation, and medical devices etc.



# What role does a Mechanical Engineer play in our society and in Industries?

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Mechanical engineers are involved in almost every aspect of human existence and welfare, including machines, cars and other vehicles, aircraft, power plants, automobile parts, and manufacturing plants etc. A Mechanical Engineer plays a significant role in designing, developing, and testing machines as well as thermal devices. It also includes systems that are essential to many aspects of modern society and Industries. They use their knowledge of mechanics, thermodynamics, materials science, and energy to create solutions that improve the quality of life of people.

# Besides, the role of a mechanical engineer in our society is contributed as:

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1. Power Generation: Mechanical engineers design and develop power-generating machines such as internal combustion engines, gas turbines, and steam and wind turbines etc.

2. Heating and Cooling Systems: They design and develop heating, ventilation, refrigeration and air conditioning systems for buildings and other structures.



3. Transportation: Mechanical engineers are involved in designing and developing transportation systems, including cars, trains, airplanes, steamers and boats.

4. Industrial Equipment: They design, develop and maintain industrial equipment such as machine tools, robots, and conveyor systems & belts.

5. Infrastructure: Mechanical engineers play a key role in the design and maintenance of infrastructure, including buildings, bridges, roads and transportation systems.

Overall, Mechanical Engineers are involved in designing, building and maintaining the engines, machines and structures that make modern life possible and comfortable.

They contribute to society by using their skills to improve the safety, security, efficiency and comfort of the systems and devices that we rely on everyday.

# Emerging Trends and Technologies in energy sector

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Renewable energy infrastructure development, power generation, storage, and efficiency drive innovations in the sector with numerous emerging companies developing low-cost renewable energy technology.

### a) Renewable:

Renewable is one of the emerging trends in energy sector. This Renewable energy trend helps to safeguard the environment by emitting little to no harmful pollutants. The fundamental premise of renewable energy is to obtain it from a consistent source in the environment, such as the sun, wind, or geothermal sources. The source is then converted into useful power or fuel. A variety of technologies that address various facets of generating power and heat from renewable sources is one of the latest technology trends in renewable energy. This involves lowering the cost of building renewable infrastructure and enhancing the efficiency of power generation.

### b) Energy Storage

Energy storage is one of the effective energy industry emerging trends. Energy storage permits steady pricing by proactively maintaining demand from consumers. In response to shifting energy demands and technological advancements, the energy storage business has evolved, adapted, and innovated during the last century. Energy storage systems offer a diverse set of technological solutions for improving our power supply to build more resilient energy infrastructure and save money for utilities and customers.

The many methods of energy storage can be classified into five categories based on their technology:

- Batteries
- Thermal
- Mechanical
- Pumped hydro
- Hydrogen

It has the potential to save consumers money while also improving dependability and resilience, integrating power sources, and reducing environmental impacts.

### c) Blockchains:

Blockchains or distributed ledgers are emerging technology trends in the energy industry that has drawn significant interest from energy supply firms, start-ups, financial institutions, Governments, technology developers, and the academic community' Block chain technology proposes to combine all energy stakeholders under a single decentralized system. Electricity producers, metering operators, distribution network operators' and traders potentially avail from utilizing smart contracts. These agreements ensure that all energy related transactions are routed through a safe and immutable network, reducing the risk of losses. Block chain also has the ability to achieve some degree of equity between energy generators and consumers.

# Emerging Trends and Technologies in Manufacturing sector

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AI robots, 3D printing, and the like are all the latest manufacturing trends in manufacturing technology - and have been for some time. 2021 is the year. Manufacturing technology gets even smarter. Robots on the factory floor are growing quickly thanks to their declining cost and increasing capabilities.

# Emerging Trends and Technologies in Automotive sector

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The automotive industry has been experiencing a great deal of change within the past several years. More software is being added to vehicles, along with a greater number of electric and autonomous vehicles are in production and on the road. Here are the most common automotive trends of 2021.

- A Greater Amount of AI/Machine Learning and Connectivity
- An increase In Electric and Autonomous Vehicles .
- Software Security Has Become a Top Concern Electrification .
- Artificial intelligence (AI).
- Human-Machine interface.

# Emerging Trends and Technologies in Aerospace sector

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Aerospace collectively refers to the atmosphere and outer space; it's a diverse industry with a multitude of commercial, industrial, and military applications. Aerospace engineering consists of aeronautics and astronautics and the research, design, production, operation, or maintenance of aircraft and spacecraft involves the work of numerous organizations.

# Aerospace Engineering Technology Trends

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1. Zero-Fuel Aircraft
2. Structural Health Monitoring (SHM)
3. Advanced Materials
4. Smart Automation and Block chain
5. Additive Manufacturing (3D Printing)
6. Supersonic Flights
7. More Resilient and Dynamic A&D Supply Chains
8. Utilizing Internet of Things (IoT) to Anticipate Maintenance Issues

# What is emerging technologies in the maritime industry?

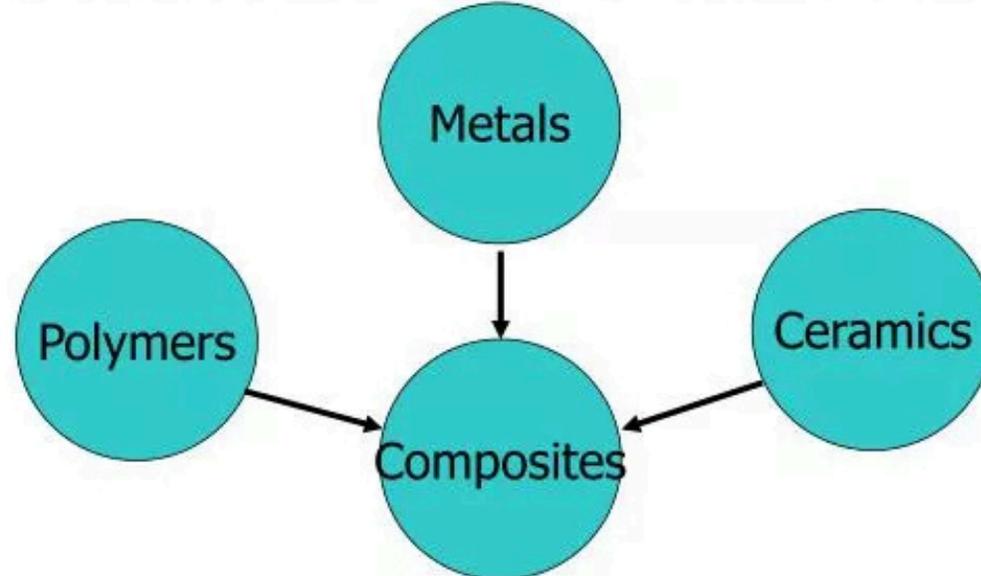
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Advances in shipbuilding, propulsion, smart shipping, advanced materials, big data and analytics, robotics, sensors and communications in conjunction with an increasingly skilled workforce are all having monumental shifts in how the maritime industry are approaching new challenges and opportunities.

# Engineering Materials – Metals- Ferrous and Non-ferrous, Ceramics, Composite etc

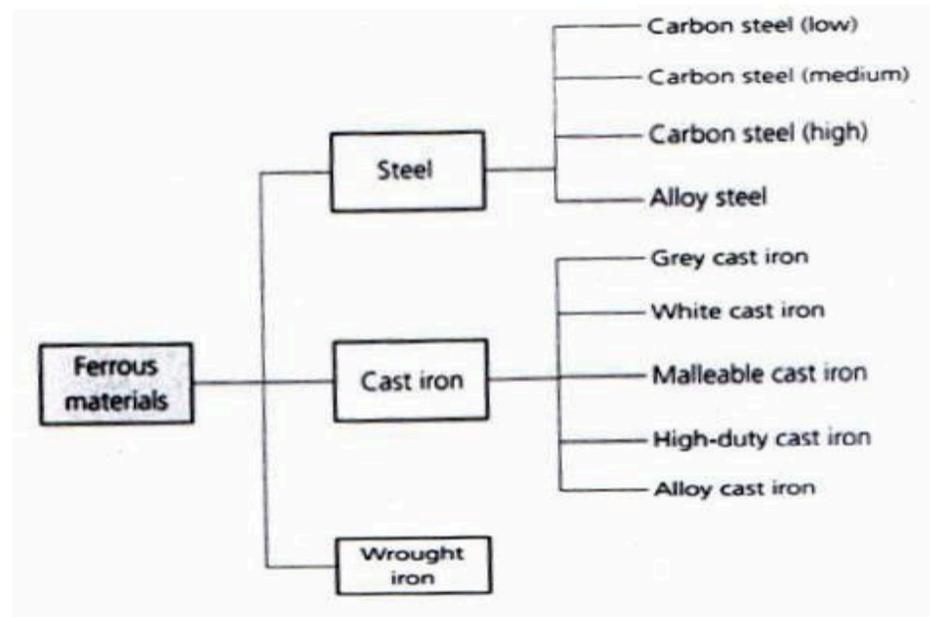
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## Classification of Materials



## 1. Ferrous metals

These are metals and alloys containing a high proportion of the element iron. They are the strongest materials available and are used for applications where high strength is required at relatively low cost and where weight is not of primary importance. As an example of ferrous metals such as : bridge building, the structure of large buildings, railway lines, locomotives and rolling stock and the bodies and highly stressed engine parts of road vehicles.



## 2. Non – ferrous metals

These materials refer to the remaining metals known to mankind. The pure metals are rarely used as structural materials as they lack mechanical strength. They are used where their special properties such as corrosion resistance, electrical conductivity and thermal conductivity are required. Copper and aluminum are used as electrical conductors and, together with sheet zinc and sheet lead, are use as roofing materials. They are mainly used with other metals to improve their strength

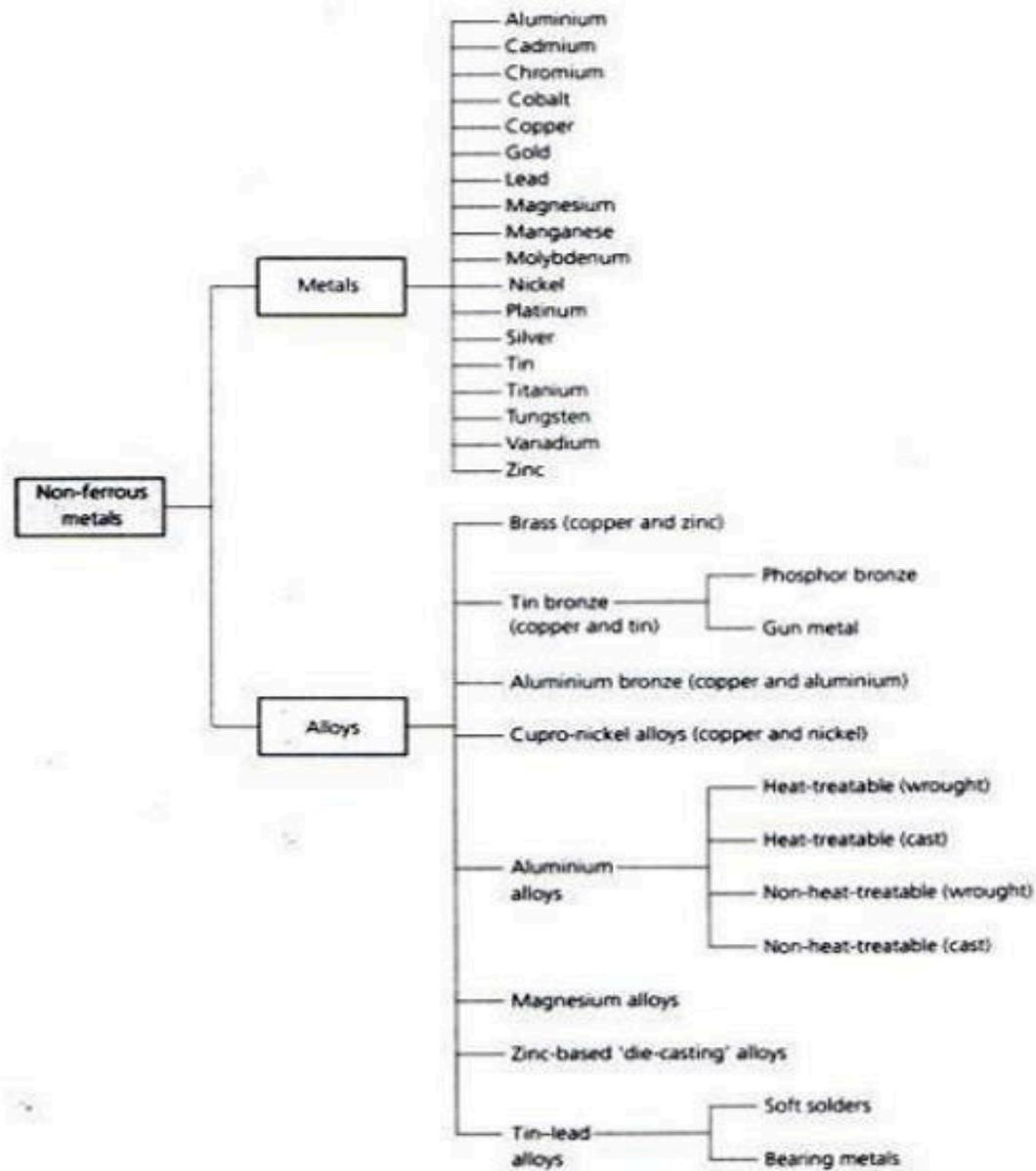
### 3.Non – metallic (Natural materials )

#### Ceramic:

These are produced by baking naturally occurring clays at high temperatures after moulding to shape. They are used for high – voltage insulators and high – temperature – resistant cutting tool tips.

Ceramics (ceramic materials) are non-metallic inorganic compounds formed from metallic (Al, Mg, Na, Ti, W) or semi-metallic (Si, B) and non- metallic (O, N, C) elements.

- Atoms of the elements are held together in a ceramic structure by one of the following bonding mechanism: Ionic Bonding, Covalent Bonding, Mixed Bonding (Ionic-Covalent).
- Most of ceramic materials have a mixed bonding structure with various ratios between Ionic and Covalent components. This ratio is dependent on the difference in the electro negativities of the elements and determines which of the bonding mechanisms is dominating ionic or covalent.





# Thank You

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