DEPARTMENT OF MECHANICAL ENGINEERING (TOOL AND DIE)

2024-25

METD- MAGAZINE

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VISION AND MISSION

INSTITUTE

PMC TECH POLYTECHNIC COLLEGE SHALL EMERGE AS A PREMIER INSTITUTE FOR VALUED ADDED TECHNICAL EDUCATION COUPLE WITH INNOVATION, INCUBATION, ETHICS AND PROFESSIONAL VALUES

- TO FOSTER THE PROFESSIONAL COMPETENCE THROUGH EXCELLENCE IN TEACHING AND LEARNING.
- TO NURTURE OVERALL DEVELOPMENT OF STUDENTS BY PROVIDING QUALITY EDUCATION & TRAINING.
- TO PROVIDE INNOVATIVE ENVIRONMENT TO LEARN, INNOVATE AND CREATE NEW IDEAS FOR THE BETTERMENT OF ONESELF AND SOCIETY.

DEPARTMENT

TO DEVELOP EMINENT INNOVATIVE PROFESSIONAL TOOL AND DIE DIPOLMA HOLDERS BY IMPARTING VALUE ADDED EDUCATION EMBEDDED WITH EMPOLYABLE SKILLS.

- TO PROVIDE COMPETENCY BASED QUALITY TOOL AND DIE ENGINEERS BY STRONG THEORETICAL AND PRACTICAL TRAINING.
- TO PROVIDE BREEDING GROUND FOR INNOVATION A LEADERSHIP THROUGH SKILL DEVELOPMENT IN TOOL DESIGN.
- TO ENHANCE CONTINUAL CAREER DEVELOPMENT AND IMPROVE EMPOLY ABILITY SKILLS.

From the Chairman

It is the matter of pride to know the release of annual magazine “METD” of Mechanical Engineering (T o o l & D i e) Department. The name and fame of an institute depends on the competence and achievements of the students and the faculty. In addition to thenumerous achievements of the year is yet another mile stone in their curricular. I hope this magazine will bring out creative talents of the students of the institute. I congratulate the Principal, HOD, Staffs and Students for publishing “METD Magazine”. My best wishesfor the success of the effort of the department.

Mr. KUMAR P
Chairman
PMC Tech Group of Institutions, Hosur

From the Secretary

I am happy that “METD” of Mechanical Engineering (T o o l & D i e) of our Er. Perumal Manimekalai Polytechnic College is releasing annual magazine “METD”. Apart from achieving excellence in academics and sharpening technical skills it is important for students to develop leadership skills and capacity to innovate for social causes to make them resourceful and employable. I extend my best wishes to the team to make this magazine“METD” a memorable one.

Smt. MALLAR .P
Secretary
PMC Tech Group of Institutions, Hosur

From the Director

I feel extremely amusement to observe that of Department of Mechanical Engineering (Tool& Die) is bringing out annual magazine "METD" with the dedicate and committed efforts of faculty and students of the department. This magazine is the reflection of the students, involved in various activities. I congratulate the HOD, the faculty members and the students of mechanical engineering (Tool and Die) department for their ingenuity and enthusiasm for this magazine and wish them all success.

Prof. SUDHAKARAN.N
Director
PMC Tech Group of Institutions, Hosur

From the Principal

It is always a pleasure to be a part of a team which strives to bring out the talents of students and staff. Mechanical engineering (Tool and Die)department has always been striving to keep itself ahead of the competition. The essential purpose of a magazine is to inform, engage, inspire and entertain a diverse readership including alumni, parents, students, faculty, staff and other friends of the college by telling powerful stories that present a compelling, timely and honest portrait of the college andits extended family. This Magazine has made an earnest attempt in this direction and brought out certain aspects to the eyes of the public so that they may understand and know the MECH(T-D) department even better.

Er.BALASUBRAMANIAM N
.Principal
PMC Tech Polytechnic College, Hosur

From the HOD

I feel privileged in presenting the magazine "METD" of our department. This magazine is intended to bring out the hidden literary talents among the students and the faculty and also to inculcate leadership skills among them. I am sure it will be a source of inspiration for the budding poets and writers among the students and will direct their creativity to new dimensions of mature expression. I extend my sincere thanks to the editorial team for their constant effort and support in bringing out the magazine in the present form. I acknowledge my gratitude to our principal for their continuous support toprepare these issues of magazine. Last but not least; I am thankful to all the authors who have sent their articles

Er. PRAKASH C
Head of the Department
Mechanical Engineering (Tool and Die)

ABOUT THE DEPARTMENT

- **Department of Mechanical Engineering (Tool & Die) was established in the year 1999 to offer a quality education for the students hailing from rural area and meet the industrial demands.**
- **The Department consists of 216 students admitted as 90 intake.**
- **Mechanical Engineering (Tool & Die) is the branch of engineering that applies the principles of physics and material science for analysis, design, manufacturing and maintenance of mechanical system.**
- **It is the branch of engineering that involves the production and usage of making design for the tool production and operation of machines.**
- **The engineering field requires an understanding of core concept including mechanics, thermodynamics, material science, jigs and fixtures, press tools, forging dies and plastic engineering.**
- **Tool & die engineers use these core principles along with the tool like computer aided manufacturing, computer integrated manufacturing, product life cycle management to design and analyze plants, equipment's and machineries.**
- **Employment opportunities available for tool and die diploma holders are found across the entire spectrum of manufacturing industry.**
- **Different carrier opportunities available for a diploma holder in tool and die making are Tool room engineers, Tool designer, plastic mould maker, Quality control engineers, Production engineers, Maintenance engineers, and CNC programmer.**
- **Higher studies opportunities are they can go for Mechanical Engineering, Production engineering, Aeronautical engineering and Post diploma in plastic technology offered by CIPET and Post Diploma Tool Design offered by NTTF.**

ACHIEVEMENT

THE DEPARTMENT OF MECHANICAL ENGINEERING (TOOL & DIE) A P P L I E D NBA ACCREDITATION FROM NATIONALBOARD OF ACCREDITATION, NEW DELHI IN THE YEAR 2022.

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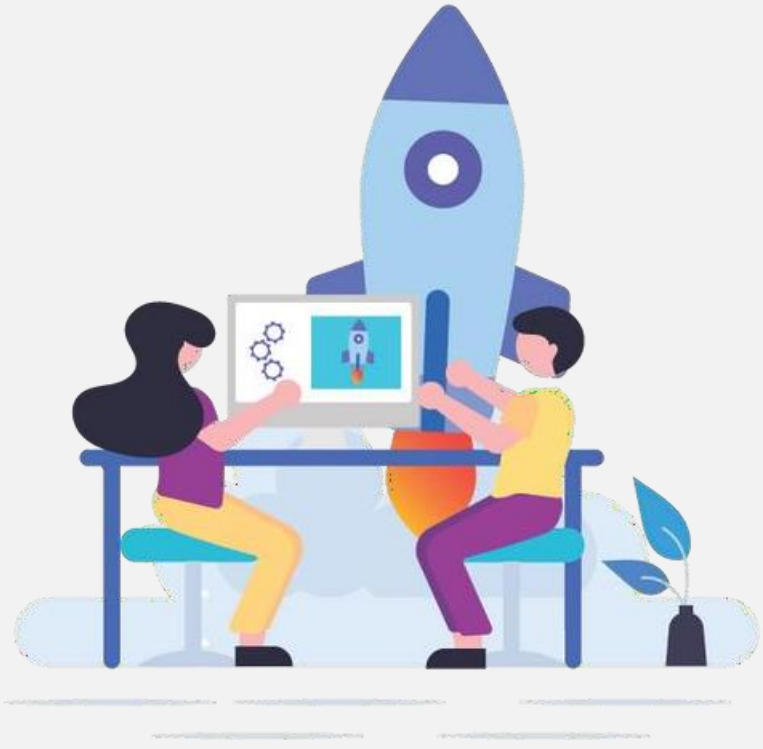


Advanced CNC Machines in Tool & Die Engineering

Introduction

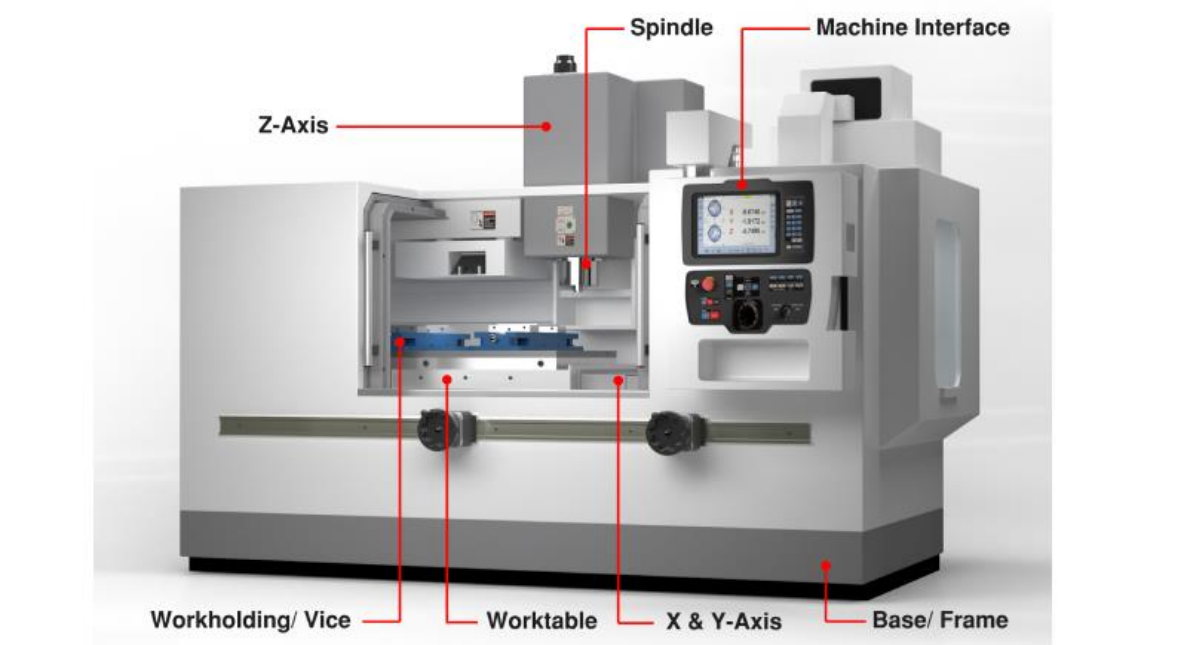
Advanced **Computer Numerical Control (CNC) machines** are highly automated manufacturing machines that operate using computer programs to control machining operations. These machines provide extremely **high precision, repeatability, and efficiency**, making them essential in Tool & Die engineering.

Advanced CNC machines are capable of performing complex machining operations such as **milling, drilling, turning, and contouring** with minimal human intervention. These machines are widely used in industries like **automotive, aerospace, electronics, and mould manufacturing**.

Working Principle of CNC Machines

The working principle of CNC machines is based on **numerical control through computer programming**.

1. The design of the component is created using **CAD (Computer-Aided Design)** software.
2. The design is converted into machining instructions using **CAM (Computer-Aided Manufacturing)** software.
3. The generated **G-code and M-code** are sent to the CNC machine.
4. The CNC controller interprets the code and moves the machine tool accordingly.
5. The cutting tool removes material from the workpiece to produce the desired shape.



Key Features of Advanced CNC Machines

1. High Precision and Accuracy

Advanced CNC machines can achieve extremely high precision, often within **microns (µm)**. This level of accuracy is essential for manufacturing tools and dies that require tight tolerances.

2. Multi-Axis Machining

Modern CNC machines can operate on **3-axis, 4-axis, or 5-axis systems**, allowing the tool to move in multiple directions. This enables the machining of complex geometries and curved surfaces in a single setup.

3. Automatic Tool Changer (ATC)

Many advanced CNC machines are equipped with **Automatic Tool Changers** that can automatically switch between different cutting tools during machining operations. This increases productivity and reduces machine downtime.

4. High Spindle Speed

Advanced CNC machines operate with high spindle speeds, sometimes exceeding **20,000 RPM**, allowing faster material removal and improved surface finish.

5. CAD/CAM Integration

CNC machines can directly use data from **Computer-Aided Design (CAD)** and **Computer-Aided Manufacturing (CAM)** software. This allows engineers to convert digital designs into machine instructions quickly and accurately.

6. Automation and Robotics Integration

Advanced CNC systems can be integrated with **robotic arms and automated material handling systems**, enabling fully automated manufacturing processes.

7. Real-Time Monitoring and Sensors

Modern CNC machines include sensors that monitor parameters such as **tool wear, temperature, vibration, and cutting forces**, improving machine reliability and product quality.

8. High-Speed Machining Capability

High-speed machining reduces production time and improves surface finish, making it suitable for complex mould and die components.

Advantages of Advanced CNC Machines

1. Improved Manufacturing Accuracy

Advanced CNC machines provide extremely precise machining operations, ensuring consistent quality in tool and die components.

2. Increased Productivity

Automation and high-speed machining allow manufacturers to produce components faster, increasing overall productivity.

3. Reduced Human Error

Since CNC machines operate based on computer programs, the chances of human errors in machining operations are significantly reduced.

4. Ability to Manufacture Complex Shapes

Multi-axis CNC machines can produce highly complex shapes that are difficult or impossible to manufacture using conventional machines.

5. Better Surface Finish

High-speed machining and advanced cutting tools produce smooth surfaces, reducing the need for additional finishing processes.

6. Cost Efficiency in Mass Production

Although CNC machines require high initial investment, they become cost-effective in large-scale production due to reduced labor costs and faster production rates.

7. Flexibility in Manufacturing

CNC machines can quickly switch between different product designs simply by changing the program, making them highly flexible for modern manufacturing.

8. Reduced Material Waste

Advanced machining strategies optimize cutting paths, reducing material waste and improving resource efficiency.

Applications of Advanced CNC Machines in Tool & Die Engineering

Advanced CNC machines are widely used in various areas of Tool & Die manufacturing, including:

- **Injection mould manufacturing**
- **Press tool production**
- **Die casting moulds**
- **Automotive component tooling**
- **Precision machining of mould cavities**
- **Complex tool and die components**

These machines ensure that tools and dies meet the strict quality requirements needed for mass production.

Future Developments in Advanced CNC Technology

The future of CNC machining is evolving with new technologies such as:

- **Artificial Intelligence-based machining systems**
- **Smart CNC machines with IoT connectivity**
- **Digital twin technology for machine monitoring**
- **Hybrid manufacturing systems combining CNC machining and 3D printing**
- **Fully automated smart manufacturing systems**

These developments will further enhance **efficiency, precision, and automation in Tool & Die manufacturing**.

Advanced Mould Making Operations in Tool & Die Engineering

Introduction

Mould making is an important process in Tool & Die Engineering used to produce plastic, rubber, and metal components in large quantities. Modern industries require high precision moulds to manufacture complex products with excellent quality and accuracy.

With the development of modern manufacturing technologies, mould making operations have become more advanced and efficient. Advanced mould making involves the use of **CNC machining, EDM processes, CAD/CAM design, and high-speed machining techniques** to produce complex moulds with high precision.

Basic Steps in Advanced Mould Making

Advanced mould manufacturing generally follows several important stages.

1. Product Design

The first step in mould making is designing the product using **CAD software**. Engineers create a 3D model of the product and analyze its design to ensure proper manufacturability.

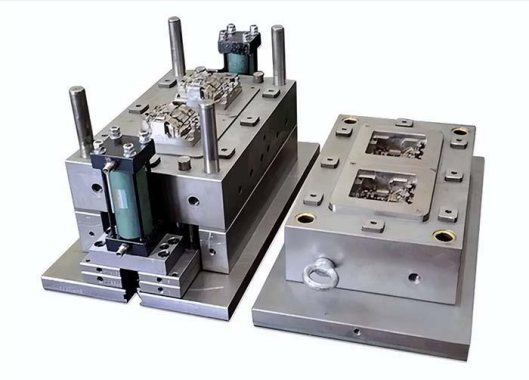
2. Mould Design

After the product design is finalized, engineers design the mould using CAD/CAM systems. This includes designing components such as:

- Mould cavity
- Core
- Runner system

Cooling channels

-
- Ejection system



3. Material Selection

The mould material is selected based on the product requirements and production volume. Common materials include:

- Tool steel
- Hardened steel
- Aluminum alloys

These materials provide strength, durability, and resistance to wear.

Advanced Mould Making Operations

1. CNC Milling Operation

CNC milling is used to machine mould cavities and cores with high precision. Computer-controlled cutting tools remove material from the mould block to create the required shape.

Features

- High precision machining
- Complex geometry manufacturing
- Computer-controlled accuracy

Applications

- Mould cavities
- Core machining
- Complex mould components

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2. EDM (Electrical Discharge Machining)

EDM is used to create complex cavities in moulds that are difficult to produce using conventional machining.

There are two common EDM processes used in mould making:

a) Die Sinking EDM

This process uses a specially shaped electrode to produce the mould cavity.

b) Wire Cut EDM

This process uses a thin wire electrode to cut precise shapes in mould components.

Advantages

- Suitable for hardened materials
- High precision
- Complex cavity machining

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3. High-Speed Machining (HSM)

High-speed machining is used to machine mould surfaces quickly and accurately. These machines operate at very high spindle speeds and feed rates.

Advantages

- Faster machining time
- Smooth surface finish
- Increased productivity

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4. Grinding Operation

Grinding is used as a finishing operation to improve the accuracy and surface quality of mould components.

Advantages

- High dimensional accuracy
- Improved surface finish
- Precision finishing

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5. Polishing Operation

Polishing is the final finishing process used to produce smooth surfaces inside mould cavities.

Advantages

- High quality surface finish
- Better product appearance
- Reduced friction in mould operation

Advanced Technologies in Modern Mould Making

Modern mould making industries use several advanced technologies to improve efficiency and quality.

1. CAD/CAM Technology

CAD/CAM software helps engineers design moulds and generate machining programs automatically.

2. Conformal Cooling Channels

Advanced moulds use cooling channels that follow the shape of the mould cavity to improve cooling efficiency and reduce cycle time.

3. Additive Manufacturing (3D Printing)

3D printing is used to produce complex mould inserts and prototype moulds quickly.

4. Smart Sensors in Moulds

Modern moulds may include sensors that monitor temperature, pressure, and performance during operation.

Advantages of Advanced Mould Making Operations

- High precision mould manufacturing
- Reduced production time
- Ability to produce complex shapes
- Improved product quality
- Increased productivity in mass production

Applications of Mould Making

Mould making is widely used in many industries such as:

- Automotive industry
- Electronics industry
- Medical equipment manufacturing
- Consumer products manufacturing
- Aerospace industry

These industries depend on high quality moulds for large-scale production of components.

Advanced Forging Operations in Tool & Die Engineering

Introduction

Forging is a manufacturing process in which metal is shaped by applying compressive forces using dies and hammers. It is one of the oldest and most important metal forming processes used to produce strong and durable components.

In modern industries, **advanced forging technologies** are used to improve product quality, reduce material waste, and increase production efficiency. These advanced forging operations are widely used in industries such as **automotive, aerospace, railway, and heavy machinery**.

Advanced forging methods combine **automation, precision dies, CNC-controlled forging machines, and advanced materials** to manufacture complex components with high strength and reliability.

Basic Principle of Forging

The basic principle of forging is to apply compressive force to a heated metal workpiece so that it plastically deforms and takes the shape of the die cavity.

Types of Advanced Forging Operations

1. Precision Forging

Concept

Precision forging is an advanced forging process that produces components with **high dimensional accuracy and excellent surface finish**, reducing the need for additional machining.

Features

- Near-net shape manufacturing
- High dimensional accuracy
- Reduced machining operations

Applications

- Automotive gears
- Connecting rods
- Engine components

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2. Closed Die Forging

Concept

Closed die forging uses two dies that contain the exact shape of the final product. When the heated metal is pressed between the dies, it takes the shape of the cavity.

Advantages

- Better surface finish
- High strength components
- Suitable for mass production

Applications

- Automotive crankshafts
- Aircraft components
- Industrial machine parts

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3. Isothermal Forging

Concept

Isothermal forging is an advanced process where the **die and the workpiece are maintained at the same temperature** during forging. This reduces temperature differences and improves material flow.

Features

- Uniform metal flow
- Reduced defects
- Improved mechanical properties

Applications

- Aerospace components
- Titanium alloy parts

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4. Warm Forging

Concept

Warm forging is performed at temperatures between cold forging and hot forging.

Features

- Improved material strength
- Reduced forming force
- Better dimensional accuracy

Applications

- Automotive components
- Gear manufacturing

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5. Automated Forging Systems

Concept

Modern forging industries use **automated forging machines and robotic systems** to improve efficiency and productivity.

Features

- Computer controlled forging operations
- Robotic handling of workpieces
- Consistent product quality

Applications

- High-volume automotive production
- Industrial component manufacturing

Advantages of Advanced Forging Operations

1. **High Strength Components**
   Forged parts have superior mechanical properties compared to cast or machined parts.
2. **Improved Grain Structure**
   Forging aligns the grain structure of the metal, increasing strength and durability.
3. **Reduced Material Waste**
   Precision forging produces near-net shapes, minimizing material loss.
4. **High Production Efficiency**
   Automated forging systems increase productivity in mass production.
5. **Better Product Reliability**
   Forged components are more reliable and resistant to fatigue and impact.

Applications of Forging in Industry

Advanced forging operations are used in many industries, including:

- Automotive industry
- Aerospace industry
- Railway industry
- Oil and gas industry
- Heavy machinery manufacturing

Common forged components include:

- Crankshafts
- Connecting rods
- Gears
- Bolts and fasteners
- Turbine components

Future Trends in Forging Technology

The future of forging technology includes several innovations such as:

- **AI-based forging process control**
- **Smart forging machines with sensors**
- **Hybrid forging and additive manufacturing**
- **Energy-efficient forging systems**
- **Advanced simulation software for forging design**

These developments will improve **efficiency, precision, and sustainability in forging industries**.

Future in Tool & Die Making

Introduction

Tool and Die making is a specialized field of manufacturing engineering that focuses on the design and production of tools, dies, moulds, and fixtures used in mass production industries. These tools are essential for manufacturing a wide range of products such as automotive parts, electronic components, plastic products, and industrial equipment.

With the rapid development of modern technologies, the field of Tool & Die making is undergoing significant transformation. Advanced technologies such as **automation, artificial intelligence, additive manufacturing, and smart manufacturing systems** are shaping the future of this industry.

The demand for skilled Tool & Die engineers is expected to increase as industries move toward **high precision manufacturing and Industry 4.0 technologies**.

Emerging Technologies in Tool & Die Making

1. Artificial Intelligence in Tool Design

Artificial Intelligence (AI) is increasingly being used to optimize tool design. AI-based software can analyze different design parameters and automatically generate the most efficient tool designs.

Benefits

- Faster design process
- Optimized tool performance
- Reduced development time

2. Additive Manufacturing (3D Printing)

Additive manufacturing is transforming the way tools and moulds are produced. It allows engineers to create complex shapes that are difficult to manufacture using traditional machining methods.

Applications

- Rapid prototyping of tools
- Conformal cooling moulds
- Lightweight tooling components

3. Smart Tools with Sensors

Modern tools and dies can be equipped with sensors that monitor parameters such as **temperature, pressure, vibration, and tool wear**.

Advantages

- Real-time monitoring
- Improved product quality
- Predictive maintenance

4. Digital Twin Technology

Digital Twin technology creates a virtual model of a tool or machine that can simulate its performance in real time.

Benefits

- Predict tool failure
- Optimize production processes
- Reduce downtime

5. Nano Coating Technology

Advanced nano coatings are applied to tool surfaces to improve their hardness, wear resistance, and durability.

Advantages

- Increased tool life
- Reduced friction
- Improved machining performance

Role of Automation in Tool & Die Industry

Automation is playing a major role in modern tool rooms. CNC machines, robotic systems, and automated production lines are improving efficiency and reducing manual labor.

Automated systems can perform machining operations with high accuracy and consistency, making them ideal for mass production.

Industry 4.0 and Smart Manufacturing

Industry 4.0 is the integration of digital technologies in manufacturing processes. In Tool & Die making, this includes:

- Smart CNC machines
- IoT-based tool monitoring
- Data-driven manufacturing
- Automated quality inspection

These technologies allow manufacturers to improve productivity and maintain high quality standards.

Career Opportunities in Tool & Die Engineering

The future of Tool & Die making offers many career opportunities in industries such as:

- Automotive manufacturing
- Aerospace industry
- Plastic injection moulding
- Electronics manufacturing
- Industrial machinery production

Professionals in this field can work as:

- Tool designer
- CNC programmer
- Mould designer
- Production engineer
- Quality control engineer

DRAWINGS

Nirmal Kumar V – III Year

Hariharan N –II Year

ACTIVITY

Mechanical Engineering

F C O U P L E Z Z F Y K Q S A K Q
F M F K N U F R O Y R L I C Z M C
C Q S J K F W R J H L F F I T J K
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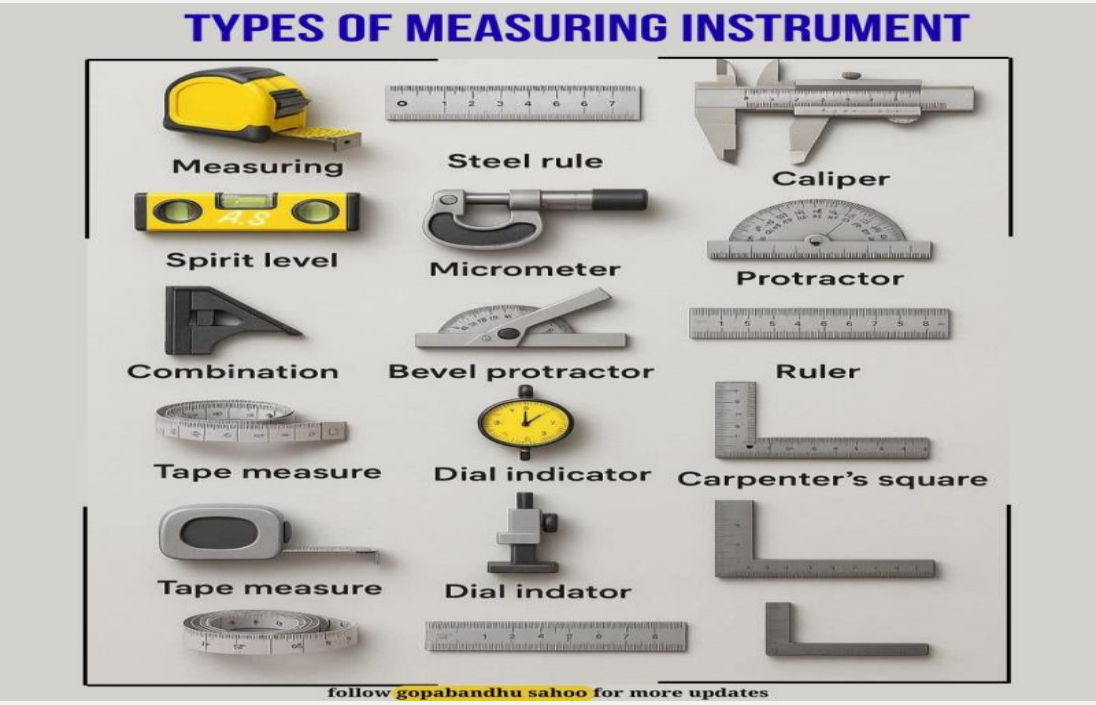
FLUIDMECHANICS VORTEXTUBE HYDRAULICS
BERNOULLI BUOYANCY ENTROPY
SPRING MOMENT COUPLE
TORQUE FORCE



PLACEMENT:

S.No	Name of the Industry	No of Students Selected	CTC
1	**Sundaram auto Components Ltd**	15	2.10
2	**Manjusree techpack Pvt Ltd**	1	2.82
3	**Essae Gears Pvt Ltd**	7	2.19
4	**Fine autocomponents Pvt Ltd**	17	3.19
5	**Maiva Pharma Pvt Ltd**	8	2.40
6	**Genau Extrusion Pvt Ltd**	2	2.10
7	**Schefeller India Ltd**	5	1.92
8	**Hyundai Pvt Ltd**	5	2.70
9	**Renault Nissan Pvt Ltd**	4	2.40
10	**SEP India Pvt Ltd**	2	2.25

No of Placement Order	No of Students
Single Order	**9**
Two Order	**13**
Three order	**9**
Four Order	**1**