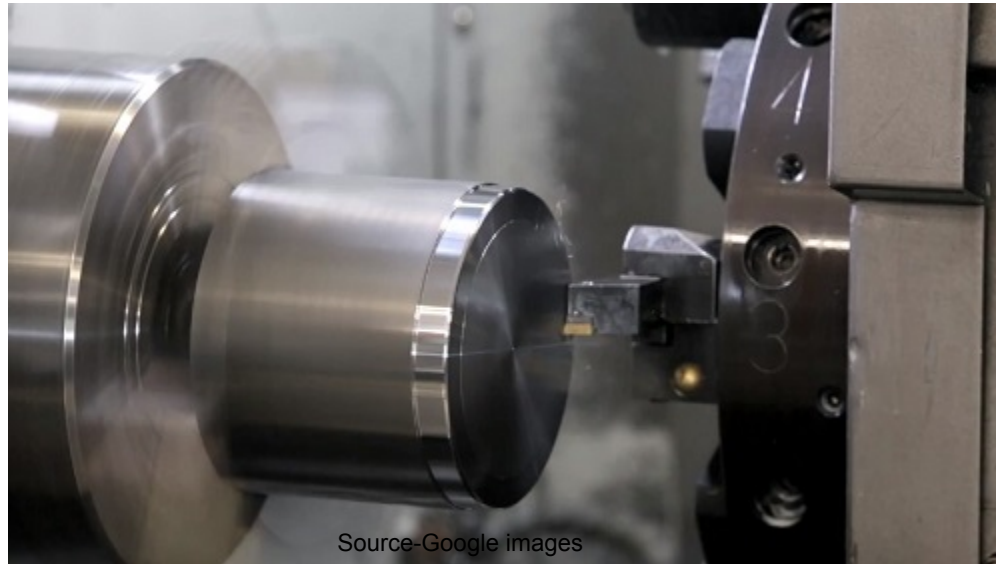


# **Metal Cutting and Machine Tool (MEL3132)**



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SMVD University, J&K**

# Syllabus

## UNIT I

- **MACHINING PROCESSES:** Introduction, History of machining, Scope and significance of machining. Types of motions in machining operations turning, boring, shaping, planing drilling and milling, broaching and grinding etc. Machining parameters, Cutting Speed, Feed and Depth of Cut and related quantities. [Sketches pertaining to relative motions between tool and work piece only]
- **CUTTING TOOL MATERIALS & CUTTING FLUIDS:** Introduction, Characteristics of Tool Materials, Various Types of Cutting Tool Materials, Coated Tools, Cutting Tool Selection, Single point cutting tool geometry. Purpose and Types of Cutting Fluids, Basic Actions of Cutting Fluids, Effect of Cutting Fluid on Tool Life

# Syllabus

## UNIT II

- **MECHANICS OF METAL CUTTING:** Introduction, Deformation of Metal During Machining, Mechanics of Chip Formation, Types of Chip, Mechanics of Orthogonal and Oblique Cutting, Merchant Cutting Force Circle and Shear Angle Relationship in Orthogonal. Temperature Distribution , Tool Chip Interface. Numericals on Cutting Forces and Merchant Circle.
- **MACHINE TOOLS:** Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, shaping machine, planing machine, grinding machine [Simple sketches showing major parts of the machines]
- **TOOL WEAR, TOOL LIFE:** Introduction, Tool wear mechanism, Tool life equations, Effect of process parameters on tool life, Machinability, Numerical problems on tool life. Economics Of Machning Processes.

# Syllabus

## UNIT III

- **GEAR MANUFACTURING:** Introduction, Methods of Manufacture, Gear Generation and Forming: Gear Cutting by Milling, Single Point Form Tool, Gear Hobbing. Gear Finishing Operations: Gear Shaving, Gear Grinding, Lapping.
- **NON-CONVENTIONAL MACHINING PROCESSES:** Abrasive Jet Machining: Principles, Applications, Process Parameters. Ultrasonic Machining: Principles, Applications, Analysis of Process Parameters. Electric Discharge Machining: Principles, Selection of Tools Materials and Dielectric Fluid. Electron Beam Machining: Generation of Electron Beam, Relative Merits and Demerits. Laser Beam Machining: Principles and Applications.
- **CNC MACHINING:** CNC Types, machining centre and part programming fundamentals of CNC machine.

# Reference Books

- Rao PN, Manufacturing Technology–Metal Cutting and Machine Tools, 3/e, TMH, New Delhi, 2013. 3.
- M. C. Shaw, Metal cutting-Principles and Practices, Cambridge University press. 2005 2.
- Bhattacharya A, Metal Cutting: Theory and Practice, New Central Book Agency, Kolkata, 2007 4.
- Winston A. Knight and Geoffrey Boothroyd, Fundamentals of Machining and Machine Tools, 3/e, Taylor & Francis Group, 2005. 5.
- Trent, E. M. and P. K. Wright, Metal Cutting, 4th edition., Butterworth-Heinemann, 2000

# Introduction

- Metals are shaped into different usable forms by various processes
- No Cutting Shaping-  
e.g. Rolling, Forging, Extruding, etc.
- Cutting Shaping-  
e.g. Turning, Milling, Drilling, Boring, Shaping etc.

# Importance of Metal Cutting

- Every product we use in daily life has used this process
- 80% of machine tools used are of metal cutting nature
- 10 to 15% of all metal produced in USA is converted into chips

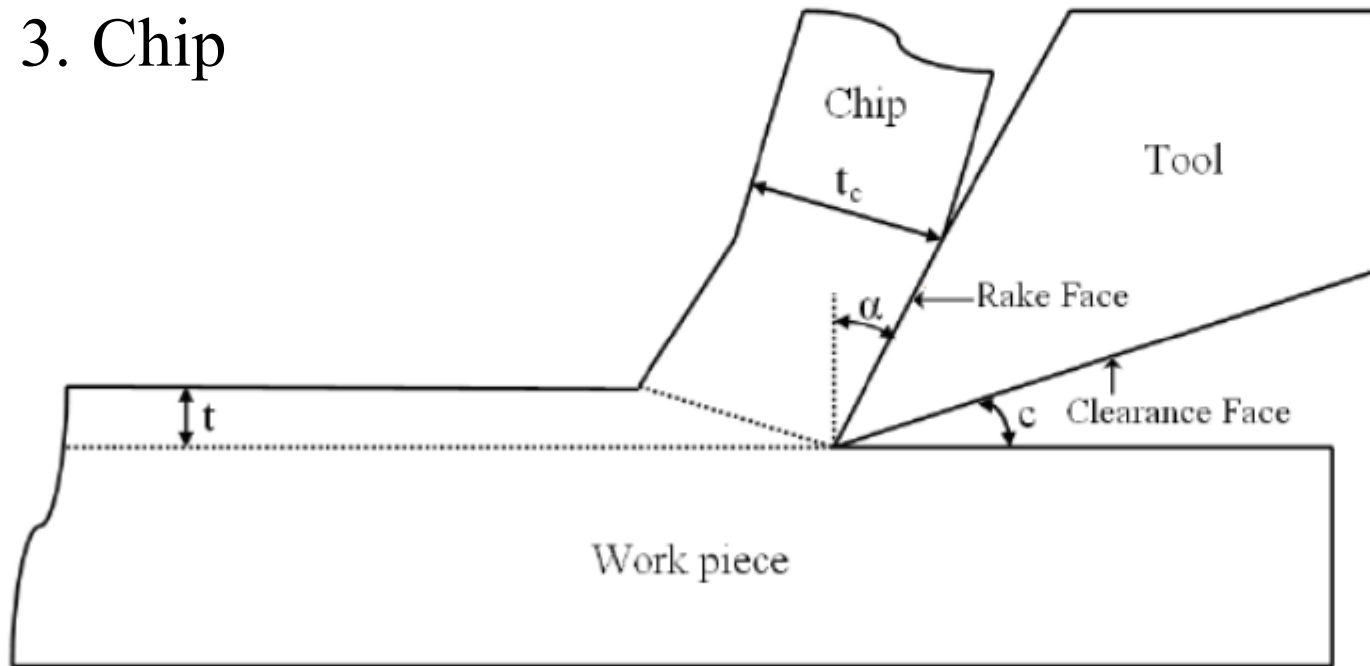
# History of Metal Cutting

- James Watt built first successful steam engine in 1776 after the invention of boring machine by John Wilkinson
- Before the end of 19<sup>th</sup> century, some work was done by Tresca, Thime, Mallock etc. (mainly scattered work)
- Monumental work by F.W. Taylor in the end of 19<sup>th</sup> and beginning of 20<sup>th</sup> century.
- 30 years of the results of his experimental work, ASME 1907 (about 300 pages)



# Basic Elements of Machining

1. Work Piece
2. Tool
3. Chip



Source-Google images

# Basic Elements of Machining

To provide cutting action relative motion between tool and work piece is required.

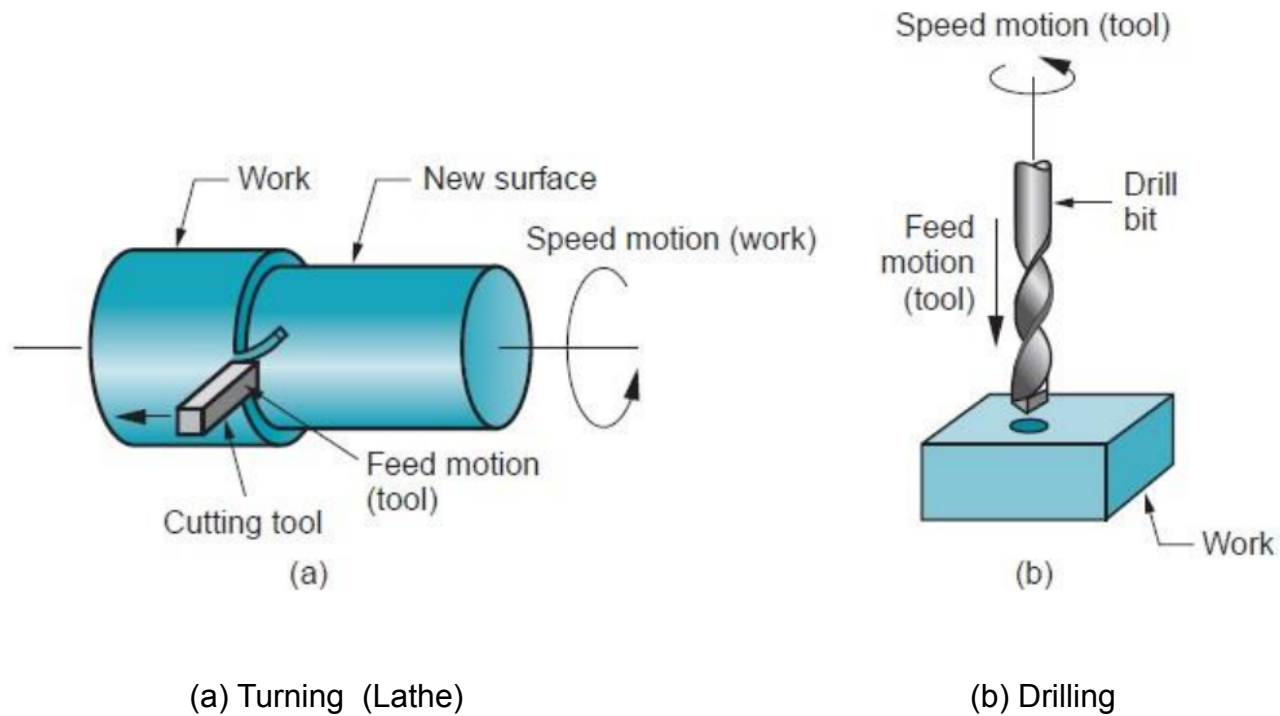
There may be 3 cases:

1. Either tool will move and w/p will be stationary
2. or w/p will move and tool will be stationary
3. or both will move in relation to one another

# Scope and Significance

1. High Metal Removal Rate
2. High Surface Finish
3. Economy in tool cost
4. Less power consumption
5. Minimum deal time of machine tool

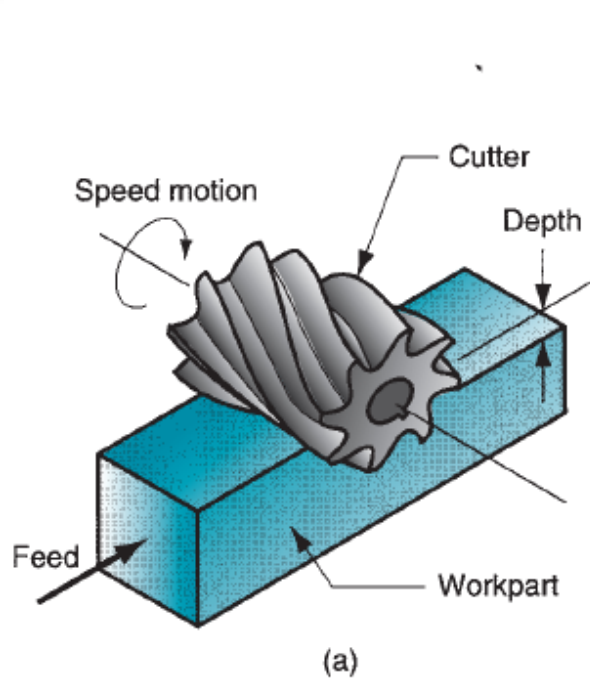
# Types of Motions in Machining



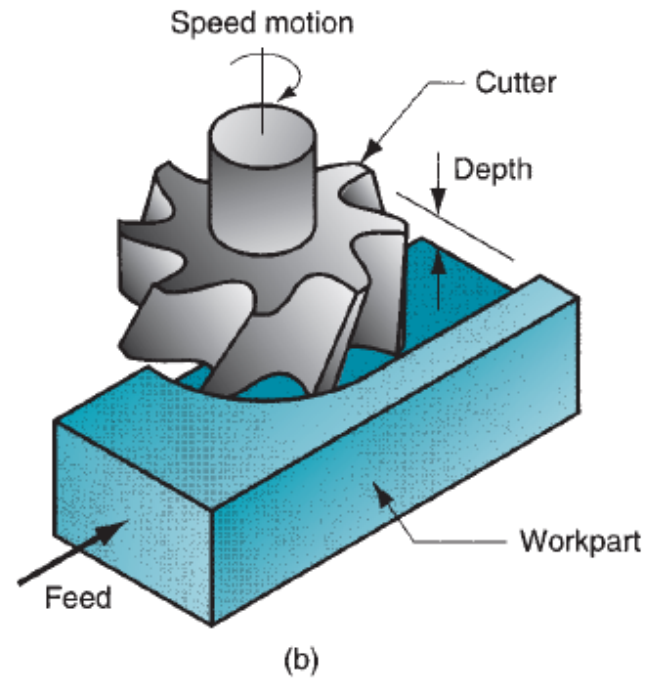
(a) Turning (Lathe)

(b) Drilling

# Types of Motions in Machining

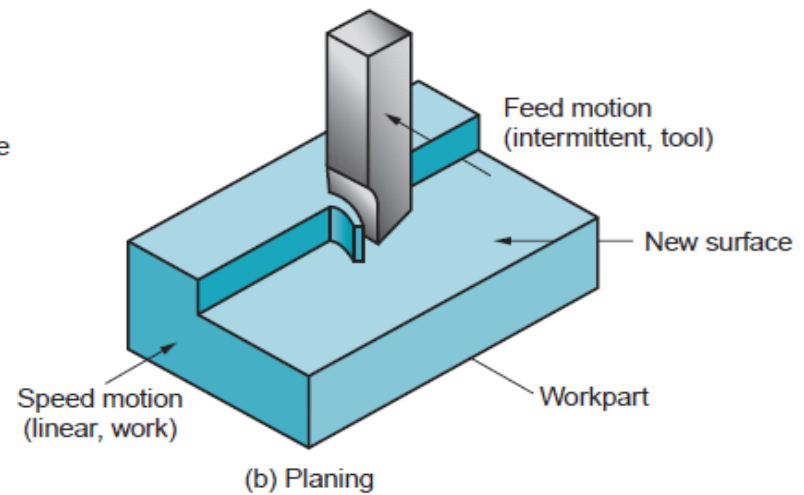
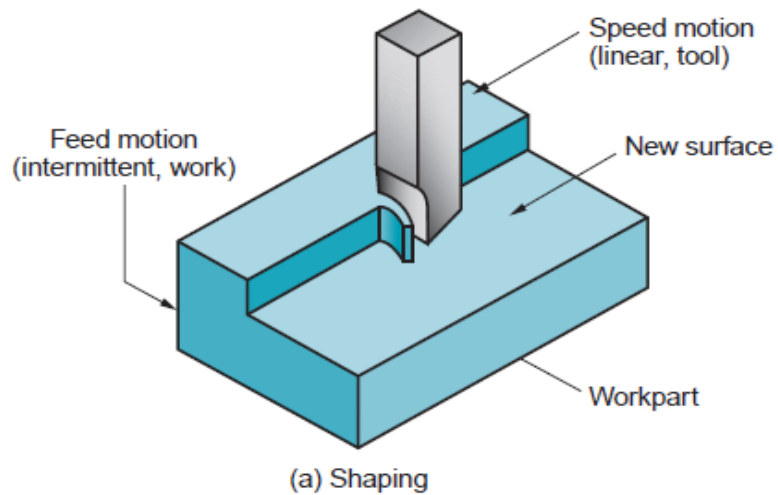


(a) Peripheral milling

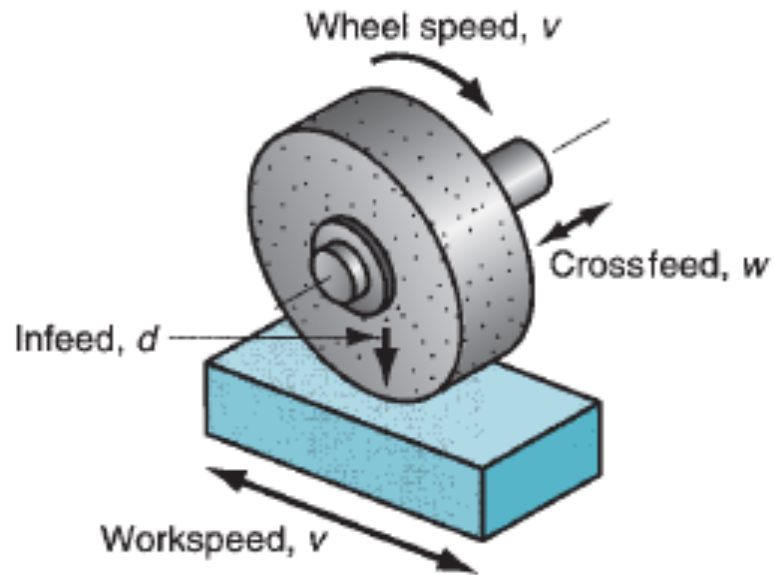


(b) Face milling

# Types of Motions in Machining



# Types of Motions in Machining



Grinding Operation





**THANK YOU**



