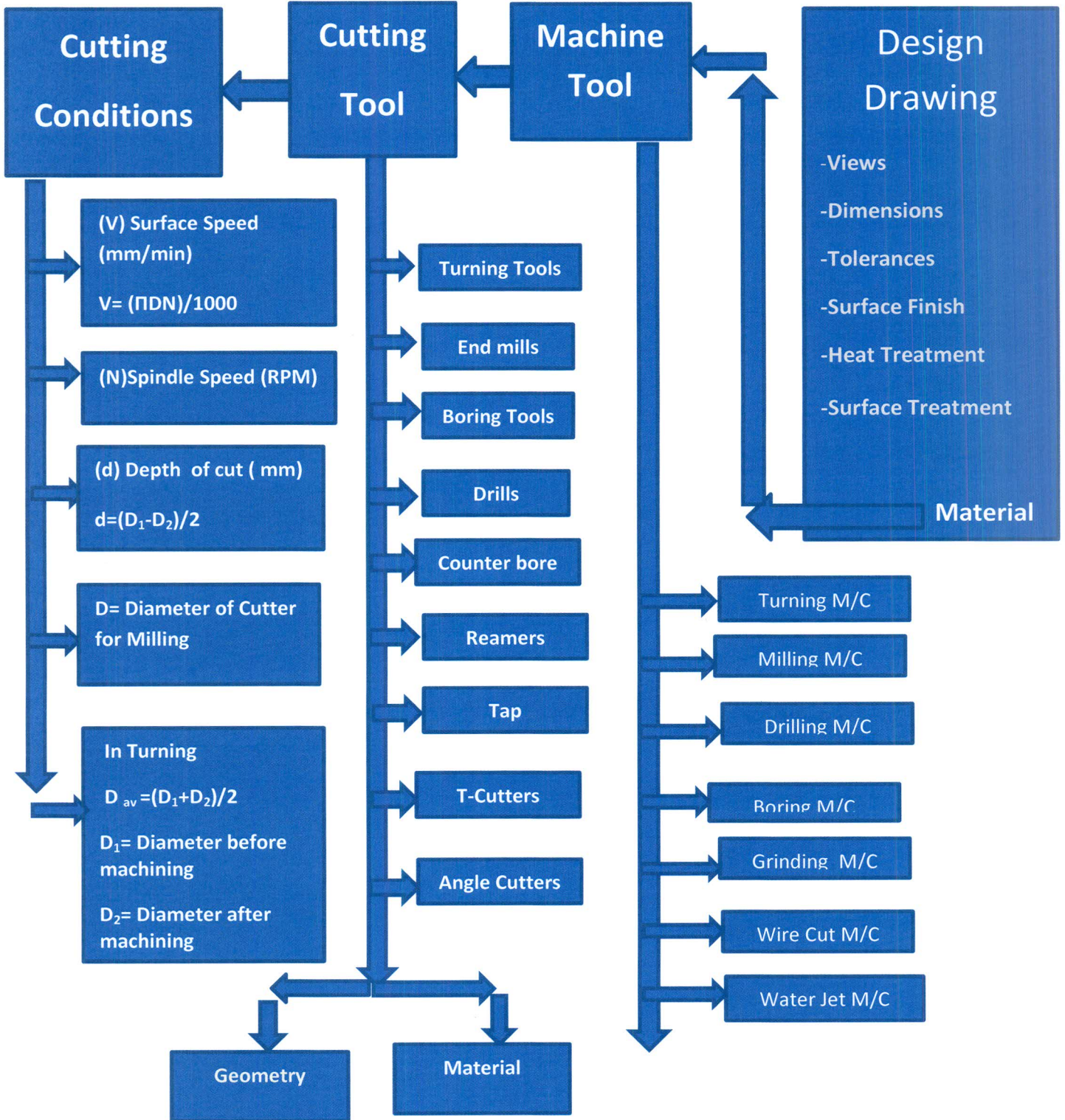


Manufacturing Processes

ME-311

Course Plan



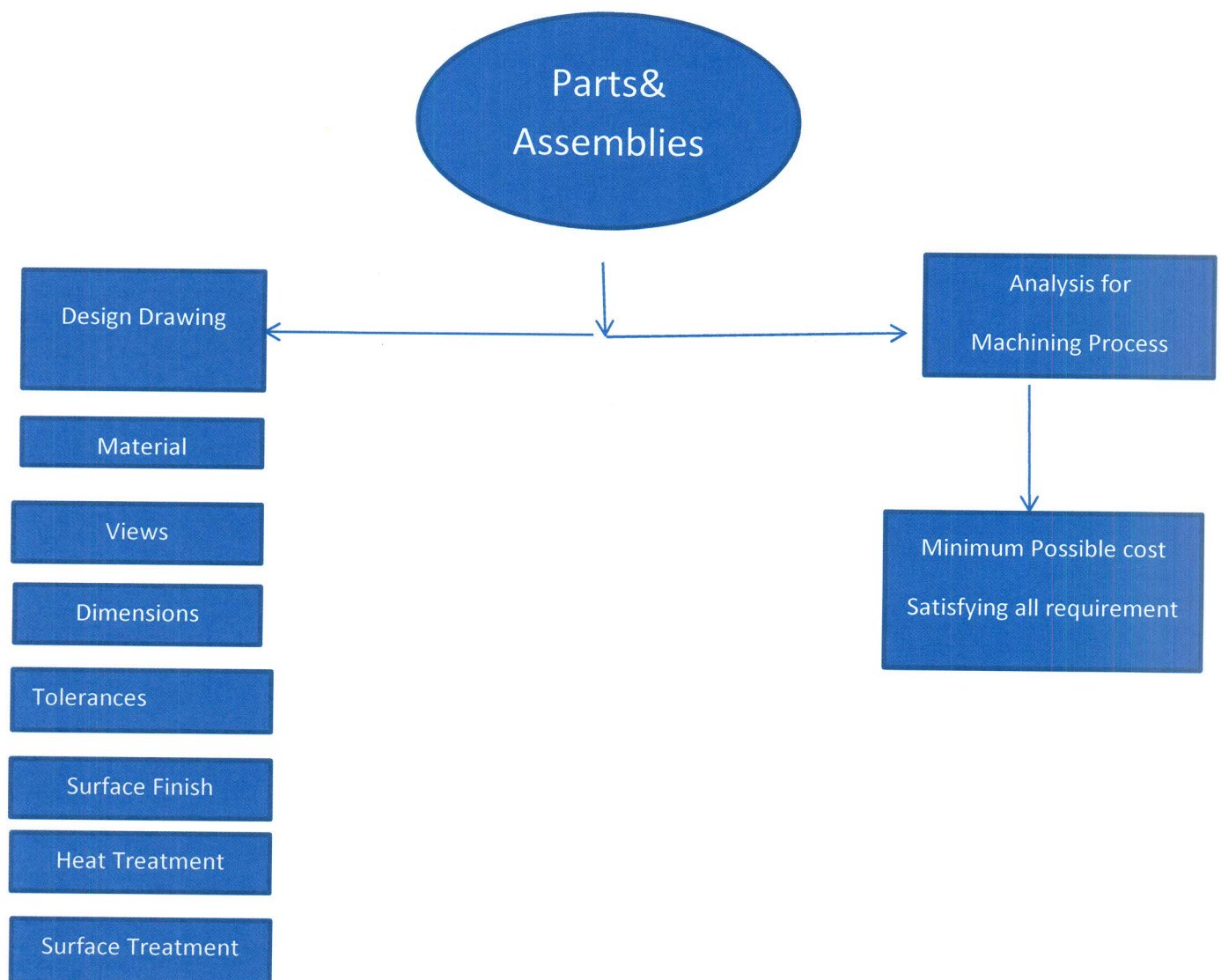
INTRODUCTION

What is the Manufacturing?

- **Manufacturing processes are the steps through which raw materials are transformed into a final product.**
- **The manufacturing process begins with the creation of the materials from which the design is made.**
- **These materials are then modified through manufacturing processes to become the required part.**
- **Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing**

What is the ultimate objective of Manufacturing Engineer?

The ultimate objective of Manufacturing Engineer is to produce the parts at most economical cost



Technology Transfer

What is the Technology Transfer?

- Assignment of technological intellectual property developed and generated in one place, to another through legal means such as technology licensing or franchising.
- Process of converting scientific and technological advances into marketable goods or services
- Technology Transfer also called Transfer of Technology (TOT) and Technology Commercialization, is the process of skill transferring, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments or universities and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. It is closely related to (and may arguably be considered a subset of) knowledge transfer.

If your country likes to start the Manufacturing Toyota Corolla,

What are the steps for that?

????

After few years they like to start the manufacturing of Honda or Mercedes?

Are the steps will be similar to the first one?

What are the steps for that?

????

Interchangeability

What does it mean?

???

The ability to select components for assembly at random and fit them together within proper tolerances.

Accuracy

What does it mean?

???

Producing parts free from errors

Repeatability

What does it mean?

???

- The ability to obtain consistent results when measuring the same part with the same measuring instrument
- Is the comparison between the same dimensions of each piece machined

Tolerance

What does it mean????

The total amount by which a given dimension may vary or the difference between the limits

The various costs associated with the machining process are:

1-The manpower cost

2-The machine tool operation cost

- Depreciation
- Oils
- Power
- Building
- Maintenance

3-The job handling cost

4-The tool cost

- Standard
- Special

The three optimization criteria that are generally considered:

- Minimization the machining cost
- Maximization the production rate
- Maximization the profit rate

The following are some of the possible constraints:

- 1- The maximum Cutting Power available at the Machine Tool Spindle**
- 2- The maximum Cutting Force permissible**
- 3- The Surface Finish and Dimensional Tolerance to be achieved on the machined surface**
- 4- The limits on the Speed, Feed and Depth of cut imposed by machine tool and cutting tool**
- 5- Maximum Permissible Cutting Temperature**
- 6- Maximum Permissible chatter**
- 7- Maximum Permissible Workpiece Static and Dynamic instability**
- 8- Tool life and Tool Fracture**

Part- I

Material Removal Process

Material Removal Process

Machining:

- Machining (Material Removal Process) of materials is basically adopted to get higher surface finish, close tolerance and complex geometric shapes, which otherwise difficult to obtain by other processes.

Machining is probably the most expensive process

Because:

1-Amount of material is removed from the raw material in the form of chips in order to achieve the require shape.

2-A lot of energy is expended in this process.

Machine Tool

- A machine tool is one which while holding the cutting tools is able to remove the metal from a workpiece in order to generate the requisite part of the given size, configuration and finish
- Machine tools are mother machines, since without them no component can be finished.
- Machine tools have been in existence for a long time and the success of the industrial revolution can be mainly attributed to them.
- Manufacturing Technology has major technological changes through various developments in microelectronics.
- The availability of computers and microprocessors has completely changed the machine tool scenario by bringing in the flexibility which was not possible through conventional mechanisms.
- The development of numerical control in 1952 brought about a kind of flexibility to the metal cutting operation.

Manufacturing Technology: Metal Cutting and Machine Tools

<i>Manufacturing process</i>	<i>Typical application</i>	<i>Size range, kg</i>	<i>Tolerance Surface Finish</i>	<i>Typical production volume</i>	<i>Relative tooling cost</i>	<i>Disadvantages of usage</i>
Turning	All materials	Unlimited	± 0.050 mm 2.0 μm	Very high	Medium	Relatively slow Material wastage
Milling	All materials	Unlimited	± 0.050 mm 2.0 μm	High	Medium	Relatively slow Material wastage
Grinding	All materials	Unlimited	± 0.025 mm 0.4 μm	High	Medium	Expensive finishing operation
Electric discharge machining	Electrically conductive materials		± 0.003 mm 0.1 μm	Low	Low	Dielectric fluid must be filtered

Types of Machine Tool

- Casting and metal working are the primary manufacturing processes where the metal is first given an intermediate shape which is usually brought to its final form through metal cutting process.
- Assembling of various parts into workable equipment often requires the mating of the complementary surfaces in terms of form, dimension and surface finish.

There are a large variety of material removal processes available such as:

- 1) Turning machines (lathes)
- 2) Drilling machines
- 3) Boring machines
- 4) Milling Machines
- 5) Grinding Machines
- 6) Shaping and Planning Machines
- 7) Gear Cutting Machines
- 8) Unconventional Machining Machines

- Besides these varieties of machine tools, we have a number of specialized variations depending upon the requirement.

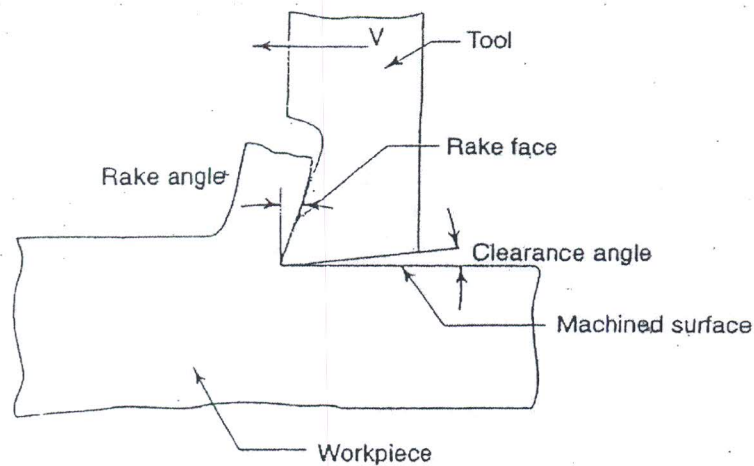
They are:

- a) Automats
- b) Copy turning machines
- c) Copy milling machines

Metal Cutting

- The importance of the machining processes can be emphasized by:
- In USA more than \$ 100 billion are spent annually on machining
- 15% of the all metal produced in USA was converted into chips

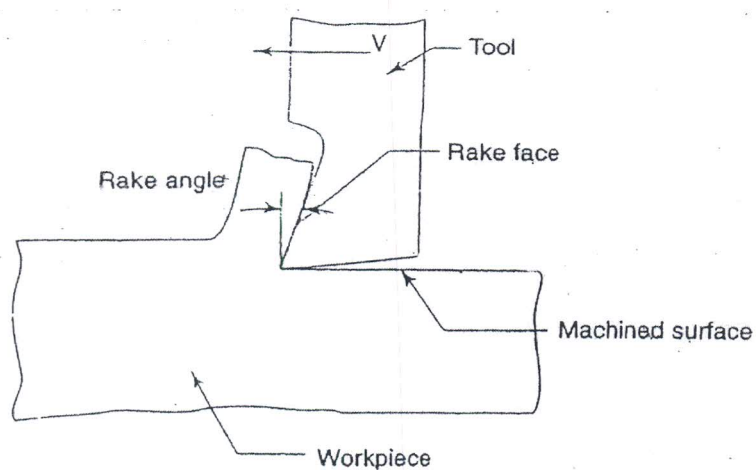
- Typical cutting tool in simplified form is shown in figure.



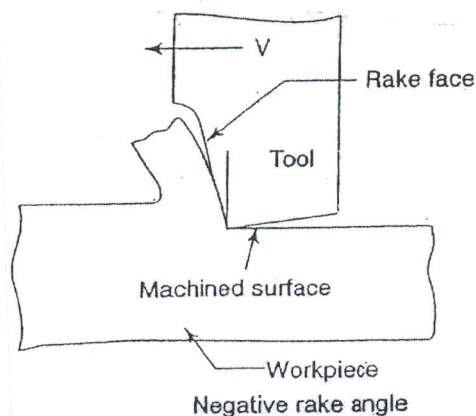
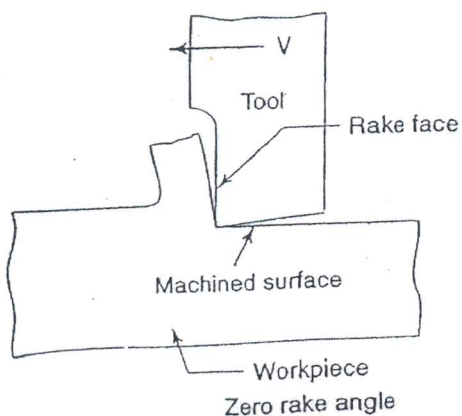
Rake Angle

- It is the angle between the face of the tool (rake face) and the normal to the machining direction
- Higher the rake angle better is the cutting and less cutting forces
- Increasing the rake angle reduces the metal backup available at the tool face. This reduces the strength of the tool tip.

- There is a maximum limit to rake angle and this is generally of the order of 15 degree for high speed steel tools cutting mild steel.
- It is possible to have rake-angles at zero or negative as shown in figure.
- These are generally used in the case of highly brittle tool materials such as carbides or diamonds for giving extra strength to the tool tip.



Positive rake angle



Clearance Angle

This is the angle between the machined surface and underside of the tool flank face

- The clearance angle is provided such that the tool will not rub the machined surface
- A very large clearance angle reduces the strength of tool tip
- The clearance angle of the order 5-6 degree

