# **ME8793 PROCESS PLANNING AND COST ESTIMATION**

## **UNIT 1 INTRODUCTION TO PROCESS PLANNING**

## **4 STEPS IN PROCESS SELECTION:**

## **PROCESS SELECTION INTRODUCTION PROCESS SELECTION:**

A process is a method of shaping, joining, or finishing a material. It is important to choose the right manufacturing process at the design stage itself. The selection of right manufacturing process depends on the materials to be used, on its size, shape and precision and number of parts to be made.

### **Classification of Manufacturing Processes**

The broad classification of manufacturing processes is illustrated



#### **Primary Processes Vs Secondary Processes**

Primary processes create shapes. The seven primary processes are casting, moulding, deformation, powder methods, methods of forming composites, special methods and rapid prototyping.

Secondary processes modify shapes and properties. They are: (i) machining, which adds features to an already shaped body, and (ii) heat treatment, which enhances surface or build properties.

The three broad manufacturing process families are:

- 1. Shaping,
- 2. Joining, and
- 3. Finishing.

### FACTORS IN PROCESS SELECTION

The materials selected in the previous stage will influence the selection of the manufacturing processes to be employed. Some of the factors to be considered in the selection of Manufacturing processes include:

- Material form
- Component size and weight
- Economic considerations
- Dimensional and geometric accuracy
- Surface finish specification
- Batch size
- Production rate

Many factors are common to both material and process selection decisions.



Material and Process selection factors

### **General Guidelines for Process Selection**

The following general guidelines can be considered while selecting the manufacturing processes

(i) Identify a manufacturing process which can providethe required dimensional/ geometric accuracy and surface finish.

(ii) To allow more choice of manufacturing processes, specify the maximum possible tolerances and surface finish variation for products

(iii) Employ prototypes to verify and validate the potential manufacturing under consideration.

Perform comparison analysis of (iv) the potential a processes manufacturing under consideration, taking into account the variation assembly different processes. in costs for

## **PROCESS SELECTION METHOD**

The selection of the manufacturing process is a difficult and complex task and hence a process selection method is required to systematically approach the task.

Assumptions Made: The following two assumptions are made in the process selection method shown

1. The materials are alerted already and we specified as the design stage

2. Comprehensive information are provided in the design documents (i.e. drawings, parts lists, etc.) and all the required information for manufacturing can be derived from drawing interpretation.

### **STAGES OF PROCESS SELECTION:**

The process selection involves the following four stages:

Stage 1: Drawing Interpretation

Stage 2: Identification of critical processing factors

Stage 3: Comparison potential manufacturing processes

Stage 4: Identification of suitable processes

These stages are presented, one by one, in the following sections.

### **Stage 1: Drawing Interpretation**

- > The drawing interpretation is the starting point for the process selection.
- From drawing interpretation, the design requirements are expressed as constraints on material, shape, size, tolerance, roughness and other process related parameters.
- The drawing interpretation can be presented under three different analysis and outputs
  - 1. Geometry analysis
  - 2. Manufacturing information

3. Material evaluation and output from drawing interpretation

The Process Shape Matrix

- The first analysis geometry analysis. The selection of manufacturing processes depends on the geometry and shape of the component/ product. The processshape matrix showing the links between component geometry and different manufacturing processes.
- The second analysis and output from drawing interpretation is the manufacturing information. The manufacturing information derived from drawing interpretation include:
  - Dimensional and geometric tolerances
  - Limits and fits
  - Surface finish requirements
  - Tolerances specifications
  - Tool references
  - Gauge references
  - ✤ Special material treatment

The third and final analysis and output from drawing interpretation is the material evaluation.

## **Stage. 2: Identification of Critical Processing Factors**

- The identification of critical processing factors is the second stage of process selection.
- The combined output from the first stage of drawing interpretation should be analyzed and correlated to identity the critical processing factors.
- The correlation of the potential manufacturing processes front the geometry analysis and the material evaluation wilt provide the opportunity to reduce the number of potential manufacturing processes under consideration.

#### **Stage 3: Comparison of Potential Manufacturing Processes**

The third stage of process selection is the comparison of identified potential manufacturing processes. In this stage, the identified potential manufacturing processes are compared using the correlated data from the second stage.

For the comparison purpose, the available appropriate process selection table can be used. The process selection tables will help the decision-making of selection of appropriate manufacturing processes using all the information gathered in previous stages.

When more titan one process satisfy all the requirements, then economic data (such as labor, equipment and tooling costs, batch size and production rate) can be used for decision making. If required, a detailed cost comparison can be carried out between manufacturing processes to help the decision making.

Also, the use of costing methods should be employed in the design and manufacture process.

#### **Stage 4: Identification of Suitable Processes.**

The fourth and final stage of process selection is the identification of a suitable manufacturing process. In this stage, using the data from the second slap and a detailed economic analysis, most appropriate manufacturing proven should be selected.

If the manufacture of part involves only one process, then the process selection is complete. Usually the component/part requires many processes. In such cases, the critical processing factor should be reconsidered and stage 3 should be repeated until all the required processes are selected.