



## FAQ of Tool Engineering

### Ch-4 Introduction

Q1: Explain concept of tool, tool design and tool engineering

Ans

#### concept of tool

→ The meaning of tools can be easily understood with the help of below given classification of tools

(1) Cutting tools such as lathe tools, milling cutters, reamers, taps, broaches and drills.

(2) Jigs and fixtures for holding the job and guiding the cutting tools.

(3) Gauges and precision instruments used for inspecting the products.

(4) Press working dies used for sheet metal fabrication.

(5) Dies used in plastic moulding, die-casting, permanent moulding and investment casting.

(6) Tool holding devices like tool post and arbor.



(7) Forging dies for hot and cold working, upsetting, extrusion and cold finishing

(8) Machine tool like lathe, shaper, milling machine etc.

### Concept of Tool design.

- The work piece drawing gives the idea regarding where the machining is required and the type of machining operations to be performed for producing a desired product.
- There after the type of tool to be used for machining operation is decided and designed to cater the need of machining.
- To hold and guide the tool we need various devices and the designing work of such devices is also called tool design.
- For measuring and inspecting the manufactured parts different gauges and instruments are used.
- The designing of such gauges and measuring instruments is also called tool design.
- Jigs and fixtures, gauges, dies etc. are designed for specific job, therefore their designing is also called tool design.



## Concept of Tool Engineering

- The tool engineering consist of analysis of different tools, planning, design, construction and applications.
- Tool engineering decides the old or new method of manufacturing for economical production.
- It is the function of this branch to bring economy in industries by co-ordinating various facilities required are used for production.
- The branch holding discussion with product design and production shop for improving product quality and reducing cost of production is known as tool engineering.
- The various sections of tool engineering are different for different types of industries as mentioned below:

(1) Process planning section

(2) Tool design section

(3) Tool room

(4) Tool control section

(5) Tool storage.



Q2. Explain types of tools, classification and features and application.

Ans

Cutting tool types :-

(1) Single point cutting tool, carbide tip tool, High speed steel tool, vee type, boring tool cutter.

(2) Multi point cutting tools

(1) Milling cutter

(4) Drill

(2) Broach

(5) Tap

(3) Reamer

(6) Grinding wheel.

(7) Hobbing tool

(3) Form tool

(4) Press tool

(5) Right hand & left hand tool.

(6) Ceramic tool

(7) Diamond tool.

→ All types of punch die & die set like blanking, piercing, shearing, notching, trimming, shaving, swaging, can and slide operated, compound, progressive, combination, bending dies, drawing die, lancing die, etc.



## Features of cutting tool:

- (1) Wear resistant
- (2) Tough and Hard.
- (3) Low friction.
- (4) Sharp edged for smooth cutting
- (5) Thermal conductor

## Application of cutting tool.

- (1) Turning
- (2) Necking
- (3) Facing
- (4) Drilling
- (5) Reaming
- (6) Boring
- (7) Milling
- (8) Shaping
- (9) Planing
- (10) Slotting
- (11) Broaching
- (12) Gear cutting
- (13) Grinding
- (14) Sawing
- (15) Punching
- (16) Slitting
- (17) Piercing
- (18) Notching
- (19) Threading



Q3 Explain function of tool engineering.

Ans.

### Tool Engineering functions

→ The working field of tool engineering is very vast. Its main functions can be classified as under

- (1) Manufacturing
- (2) Process Selection
- (3) Material Selection
- (4) Planning & Tooling
- (5) Designing

(1) Manufacturing: Any single product can be manufactured by more than one processes, machines and materials.

→ The selection of proper facility out of the various available alternatives is a difficult function to be carried out by the tool engineering.

→ Each method can be used for manufacturing the product but they yield different results and costs.

→ The scale of production plays an important role in selection of suitable method.

→ If one or two tools are to be made than

machining method is more economical.

→ The following problems are to be faced by a tool engineer in deciding method of tool manufacturing

(1) Whether complete information of product to be made is obtainable or not from the production plan?

(2) Product is to be produced in how many numbers or batches?

(3) Lead time and cost informations for manufacturing a product is available or not?

(2) Process Selection: The solution to the question as what is to be produced is obtained in production design stage and thereafter the details are described it is to be produced in the second stage.

→ For deciding this all the available processes are critically examined for their selection and finally the process which is economical, easy to adopt and capable of producing products of predecided quality is selected.

→ In the stage there is some scope of changing the product design.

- The main function to be performed by this products are always kept in mind but to produce them in required quantity. Sometimes, some changes in their design becomes necessary. This is called the product design.
- At design stage of the produce its design finalised by the consultation of the product designer and process engineer becomes suitable and proper in the circumstances prevailing at that time.
- (3) Material Selection. The selection of process is mainly based on product material.
  - Sometimes become necessary to compromise some what in process selection as per the becomes necessary available material.
  - Generally this point is considered at the design stage however tool engineer contributes in selection of material based on production processes.
  - Due to research and development in plastic and its composite material presently materials are developed giving combination of required properties at low cost.
  - Tool engineer has to remain in touch with these information, so that he can select right material.



- (4) **Planning and Tooling:** The manufacturing work is vast and complex. It is therefore necessary to decide from where it is to be started, how it should be continued further and when it is to be stopped.
- It can be decided by proper planning. The planning means to manage the manufacturing activities and other required accessories.
  - All stages of manufacturing can be completed with less labour, in less time and without any stoppage by proper planning.
  - Tooling can also be called planning of tool.
  - The time, energy and money are wasted in absence of proper tooling or tool planning.
  - Tool magazines used in CNC machine can hold more than one hundred tools at a time and provides the tool one after another as per the need of machining work.
  - In this case tool planning can be made effective by simulation using computers.
- (5) **Designing:** The complete picture of production becomes clear after completion of tool planning.



→ Therefore types of tools to be used and method of using them is to be finalized now based on different machining operations.

→ The first preference is given to the standard tools available in the market and thereafter new tools having improvements and additions are designed as per the manufacturing needs.

→ The following points are specifically remembered for tool design.

(1) Product material (2) Tool material (3) Information of machine on which the metal removal operation is to be done.

Q4 Explain trouble shooting approaches used in tool engineering. Also explain methods used by tool engineering.

Ans.

Trouble shooting approaches used in tool engineering

→ Tool engineer adopts the following practices to solve his technical problems and troubles.

- (1) Practical or Empirical approach
- (2) Analytical approach
- (3) Simulation technique.



(1) The Practical or empirical approach: This approach is used to solve simple problems where special technical troubles are not faced and job is simple.

(2) The analytical approach: is specially used when the precise products are to be produced. In this approach the problem is analysed in details. Modern technological principles are used. Again the manufacturing of product will be started after the problem is solved by the experienced tool engineer.

(3) Simulation Technique. To see the solution of problem on computer screen and then after to use it into actual practice is called simulation.

→ The defect in CNC programming may damage tool, job or machine during manufacturing. If the process of manufacturing is first viewed on the computer screen and found correct. Then there will be no harm during the CNC operation. The tools can be even corrected, modified by simulation.

### Methods used by tool engineering

→ The working method of tool engineering is changing according to the size of industry type of product and scale of production. It is mainly divided into two types, as described below



(1) Project Method: This method is popular in small industries. In this type one tool engineer look after the work of all the branches as & when need arise. He is not the expert of any department but have required knowledge of tools which are generally used.

(2) Group Method: This method is used in large industries. The different types of tools are required in such industries. The design work of each tool is assigned to the experts, because in large industries many experienced hand tool engineer are employed.

→ As per need both these methods are used in combination, then the method is called mixed method.

→ The tool engineering is a developing branch. To produce accurate products at economical cost, the tool engineering department gives its important contribution.

→ Tool engineering put forward its continuous efforts by solving tool related problems to produce accurate and cheap products.



Q5 Explain importance of tool engineering

Ans

### Importance of tool Engineering

- In modern technology, tool engineering has become important using the numerous peculiar characteristics of the tool engineer.
- Therefore tool engineer is also considered equally important. To gain the advantages of these changes, the equipments, methods and processes in use are also to be changed.
- If a CNC lathe is used in place of simple lathe without changing the cutting tools and cutting parameters, it will fail to produce required products, even though, it is a high standard modern lathe.
- The tool and toolings should be used which are fitting and suitable to CNC lathe. The design of these tools and tooling, including material selection and tool production is to be done by the tool engineer.
- Therefore to adopt the modern technology, the help of tool engineer is quite necessary.
- Using modern technology, the products will not become possible without tool engineer.



- The maintenance of quality using economical process is not an easy task.
- This is a challenge, which is again accepted by tool engineer.
- The tool engineer put forward his best efforts to achieve this goal and become successful so that industry as a whole is benefited.
- Tool engineer is very important in these days of fast developments and providing so many new processes, tools, machine tools and other accessories.