

# **COMPUTER AIDED DESIGN AND** **MANUFACTURING**

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**UNIT 1**  
**INTRODUCTION**



# SYALLABUS

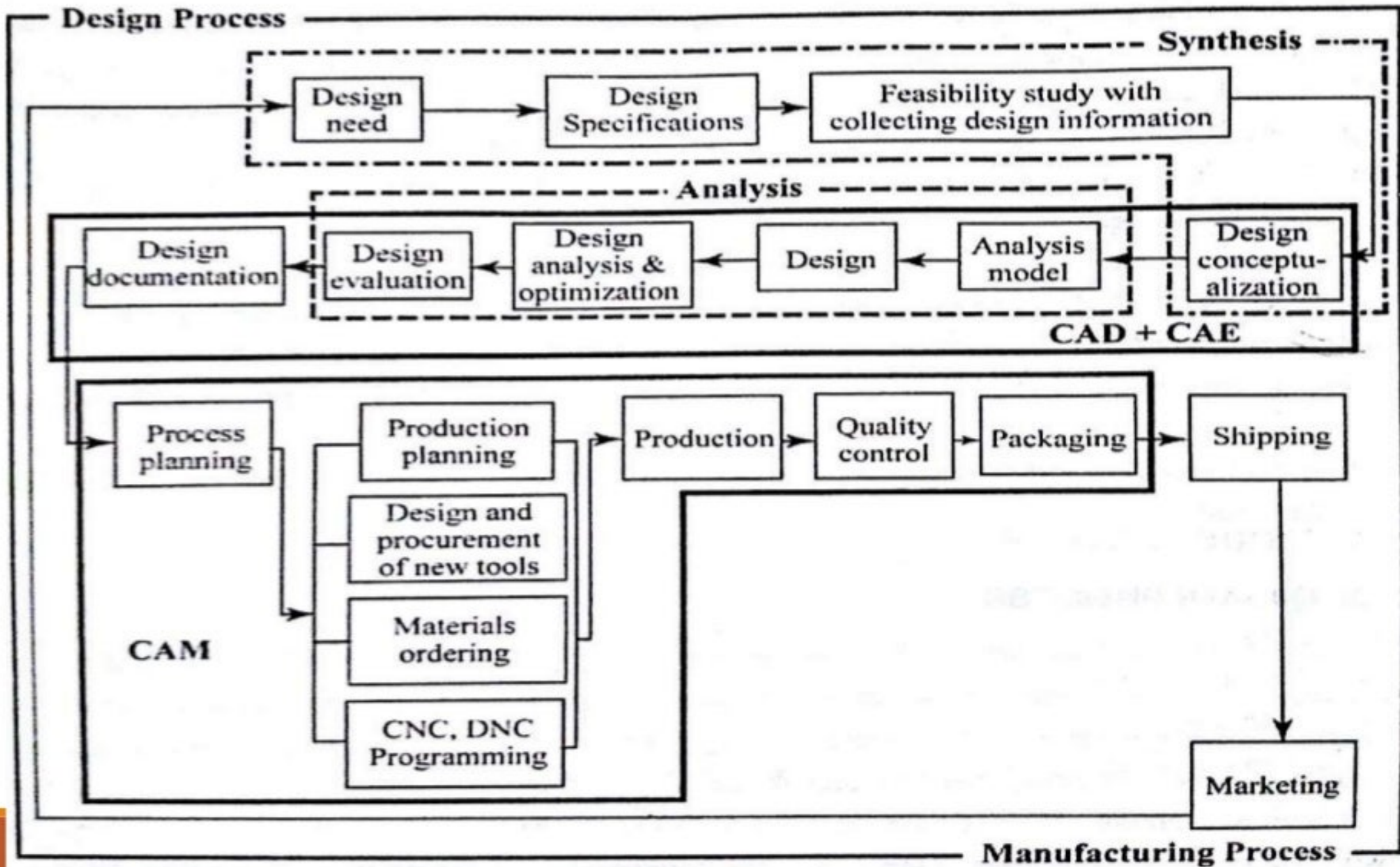
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- ❖ Product cycle, Design process, Sequential and concurrent engineering
- ❖ Computer aided design – CAD system architecture, Computer graphics
- ❖ co-ordinate systems- 2D and 3D transformations – homogeneous coordinates
- ❖ Line drawing -Clipping- viewing transformation
- ❖ Brief introduction to CAD and CAM – Manufacturing Planning
- ❖ Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts
- ❖ Types of production - Manufacturing models and Metrics
- ❖ Mathematical models of Production Performance

# Product cycle

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- ❖ The cycle through which a product goes from development to retirement is called product life cycle.
- ❖ The product cycle starts with developing the product concept, evolving the design, engineering the product, manufacturing the part, marketing and servicing.
- ❖ The product undergoes the following two main processes
  - ❖ Design process
  - ❖ Manufacturing process



# DESIGN PROCESS

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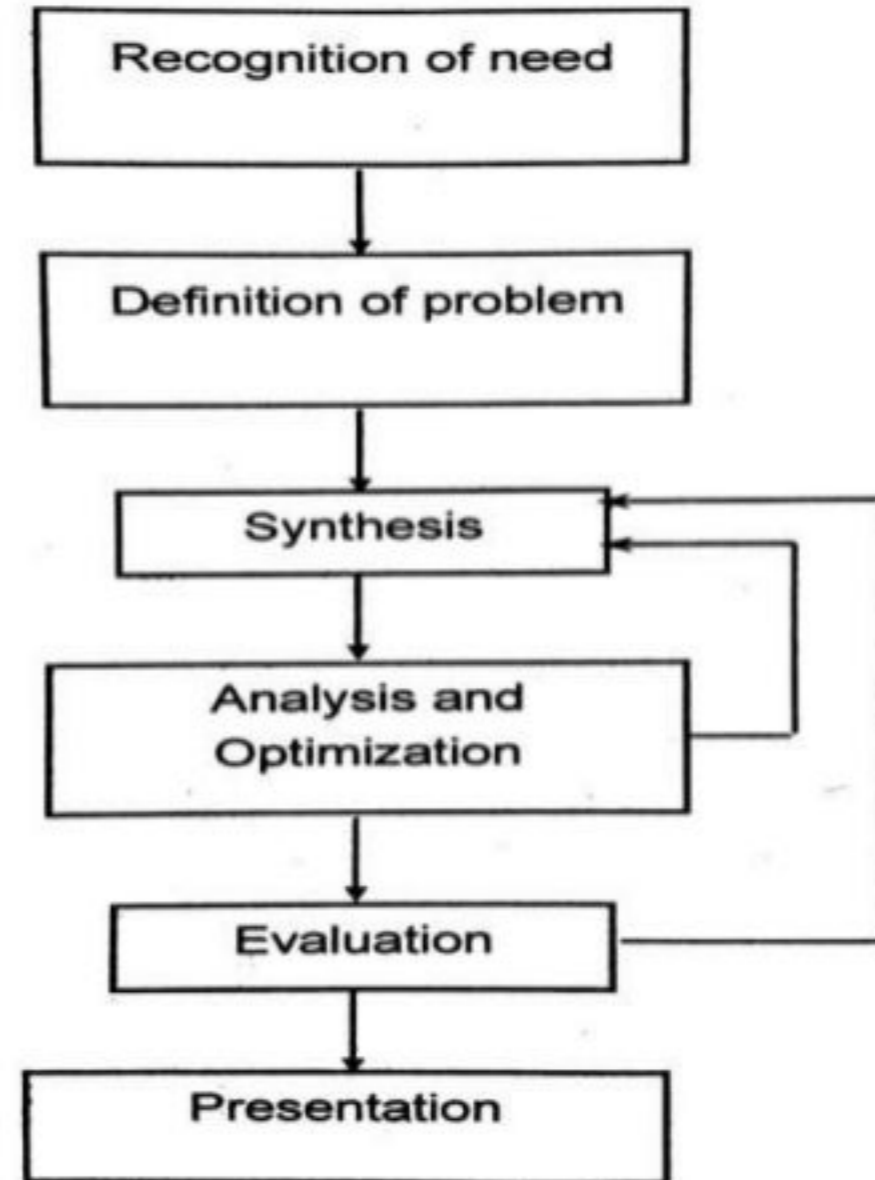
❖ Design is an activity that needs to be well organized and should take into account all influences that are likely to be responsible for the success of the product under development.

The following models are considered in design purpose

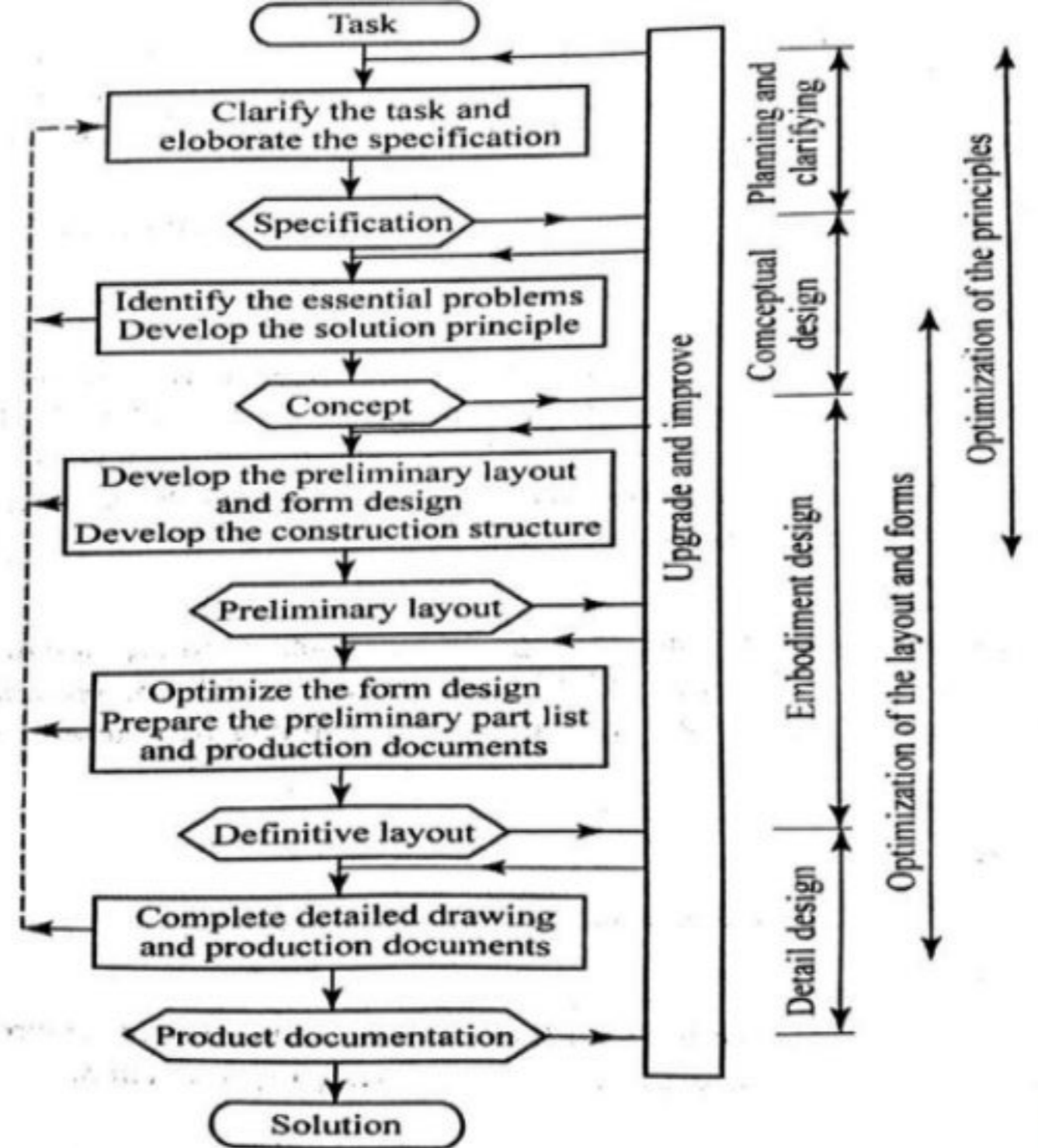
- ❖ Shigley
- ❖ Pahl and Beitz
- ❖ Ohsuga
- ❖ Earle

# Shigley design Process

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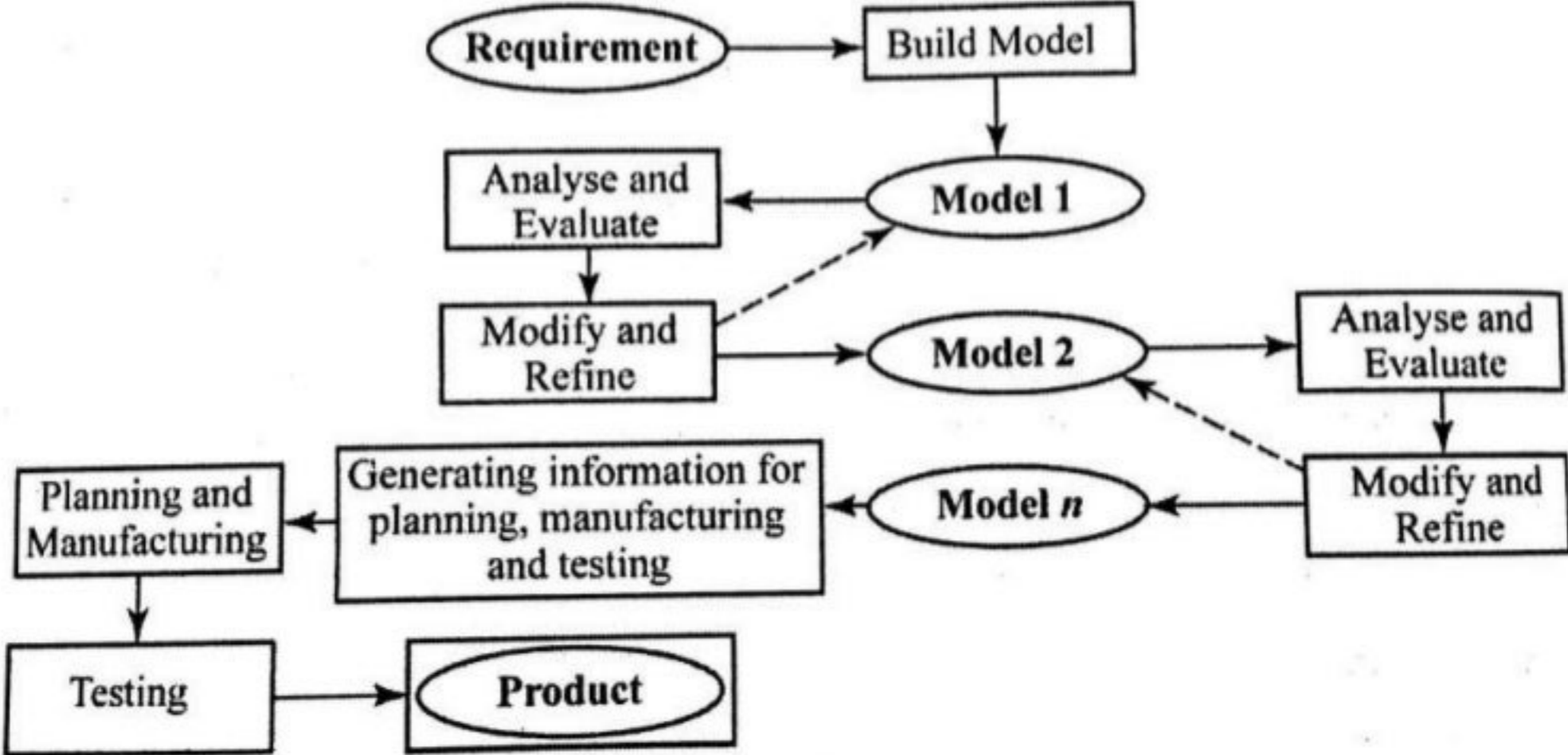


# Pahl and Beitz design Process



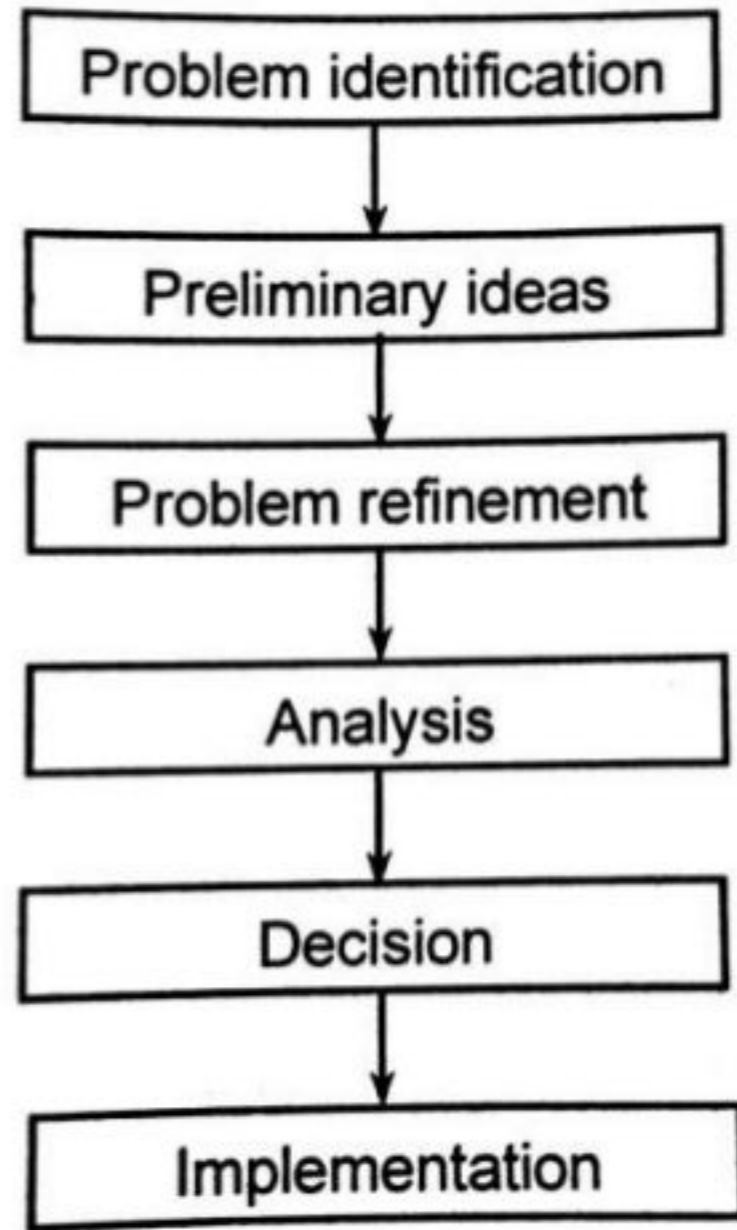


# Ohsuga design Process



# Earle design Process

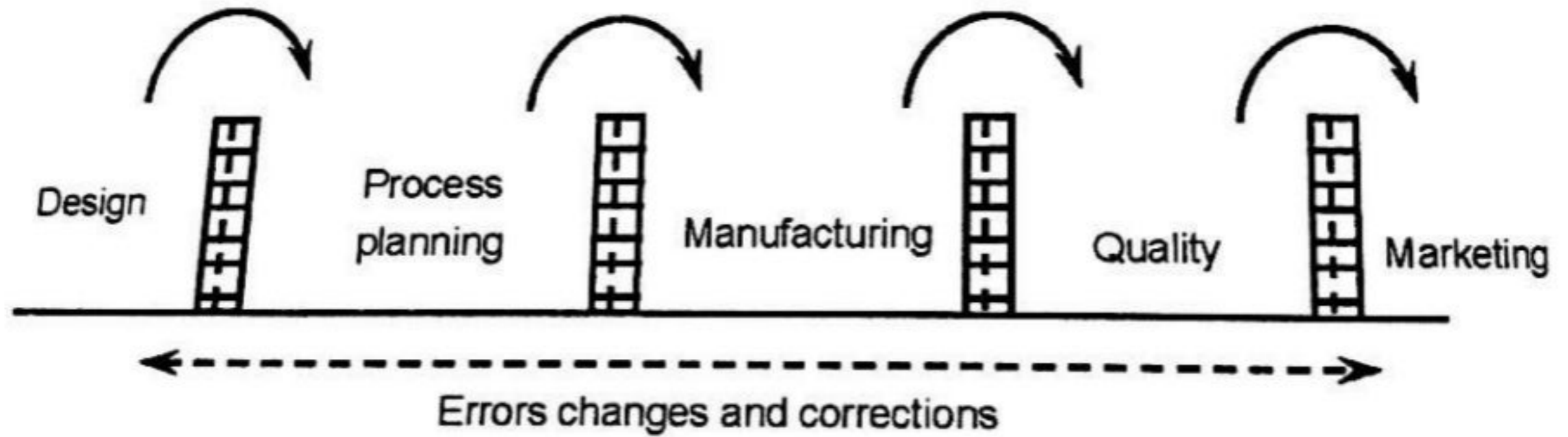
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# SEQUENTIAL ENGINEERING

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- ❖ Three major phases of conventional manufacturing process are design, process planning and manufacturing.
- ❖ All these phases are *sequentially* carried out.

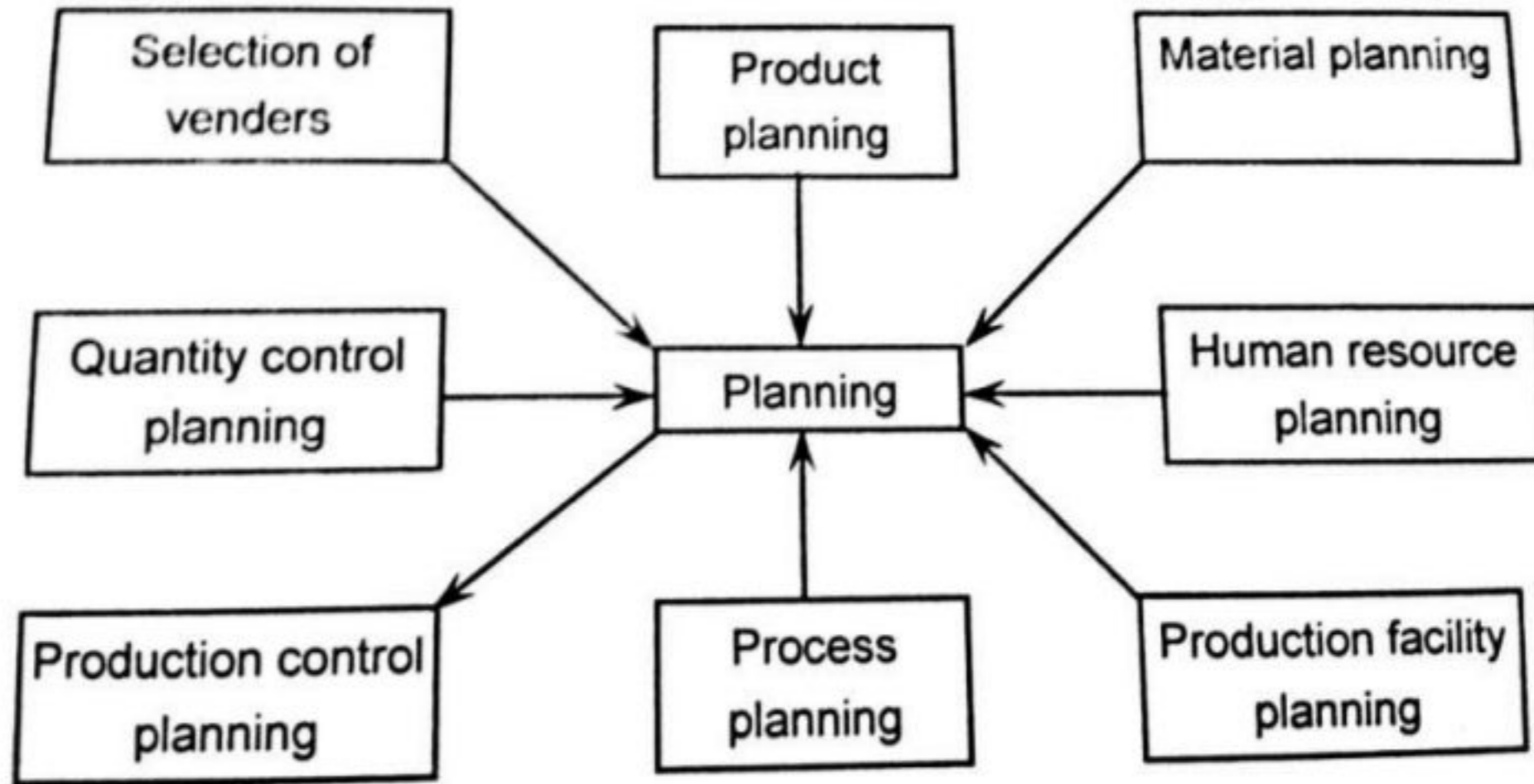


***Figure 1.10 Sequential engineering approach***

# CONCURRENT ENGINEERING

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- ❖ It is the methodology of restructuring the product development activity in a manufacturing organization using cross functional team approach.

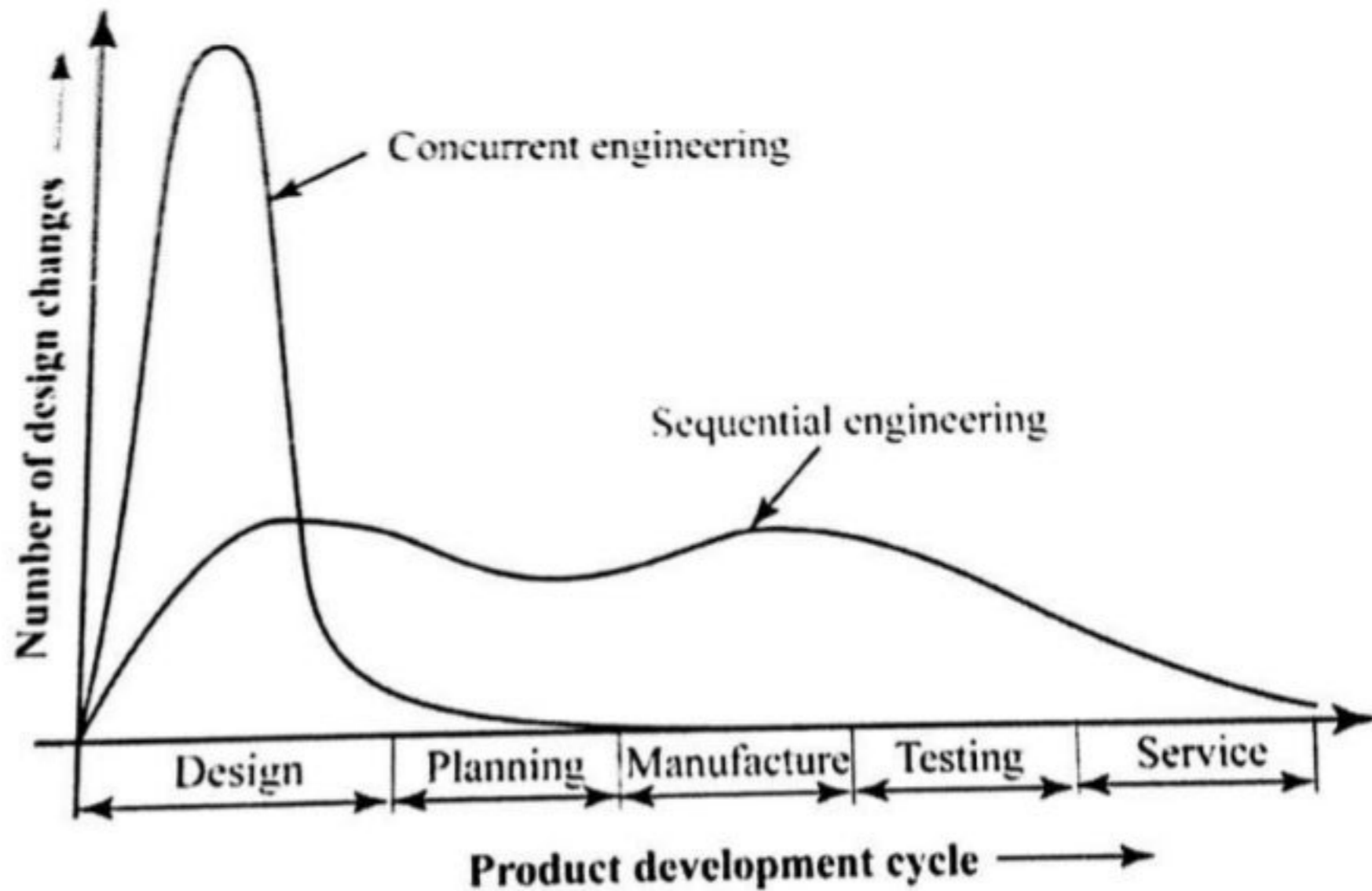


***Figure 1.11 Concurrent workflow in the planning stage***

# COMPARISON BETWEEN SEQUENTIAL AND CONCURRENT ENGINEERING

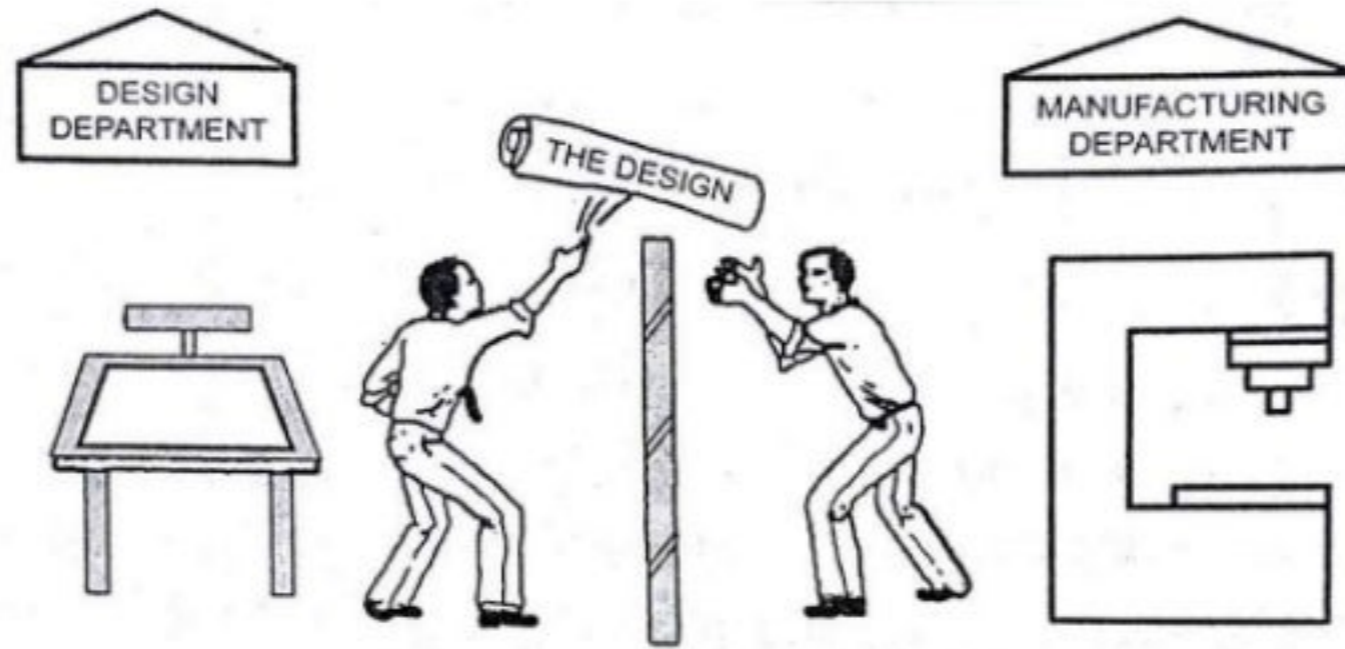
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- ❖ Product development cost
- ❖ Number of design changes
- ❖ Lead time for product development
- ❖ Customer satisfaction
- ❖ Coordination between departments

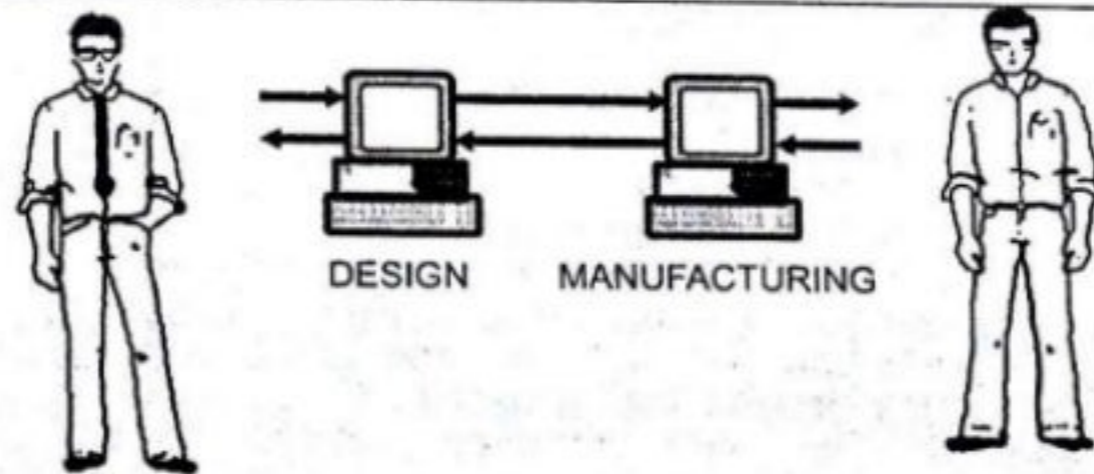


**Figure 1.12 Comparison of number of design changes in sequential engineering and concurrent engineering**





*(a) Traditional design/manufacturing communication in sequential engineering*



*(b) Design/Manufacturing communication with CAD/CAM in concurrent engineering*

# COMPUTER AIDED DESIGN

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- ❖ Groover and Zimmers defined “*CAD is the technology concerned with the use of computer systems to assist the creation, modification, analysis and optimization of a design*”.

# Roles of CAD in Design

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- ❖ Accurately generated and easily modifiable graphical representation of the product.
- ❖ User can nearly view the actual product on the screen, make any modification to it and present his ideas on screen without any prototype, especially during the early stages of the design process.
- ❖ Complex design analysis in short time. By implementing Finite Element Analysis (FEA) methods user can perform as follows
  - ❖ Static, dynamic & natural frequency analysis
  - ❖ Heat transfer analysis
  - ❖ Fluid flow analysis
  - ❖ Plastic analysis

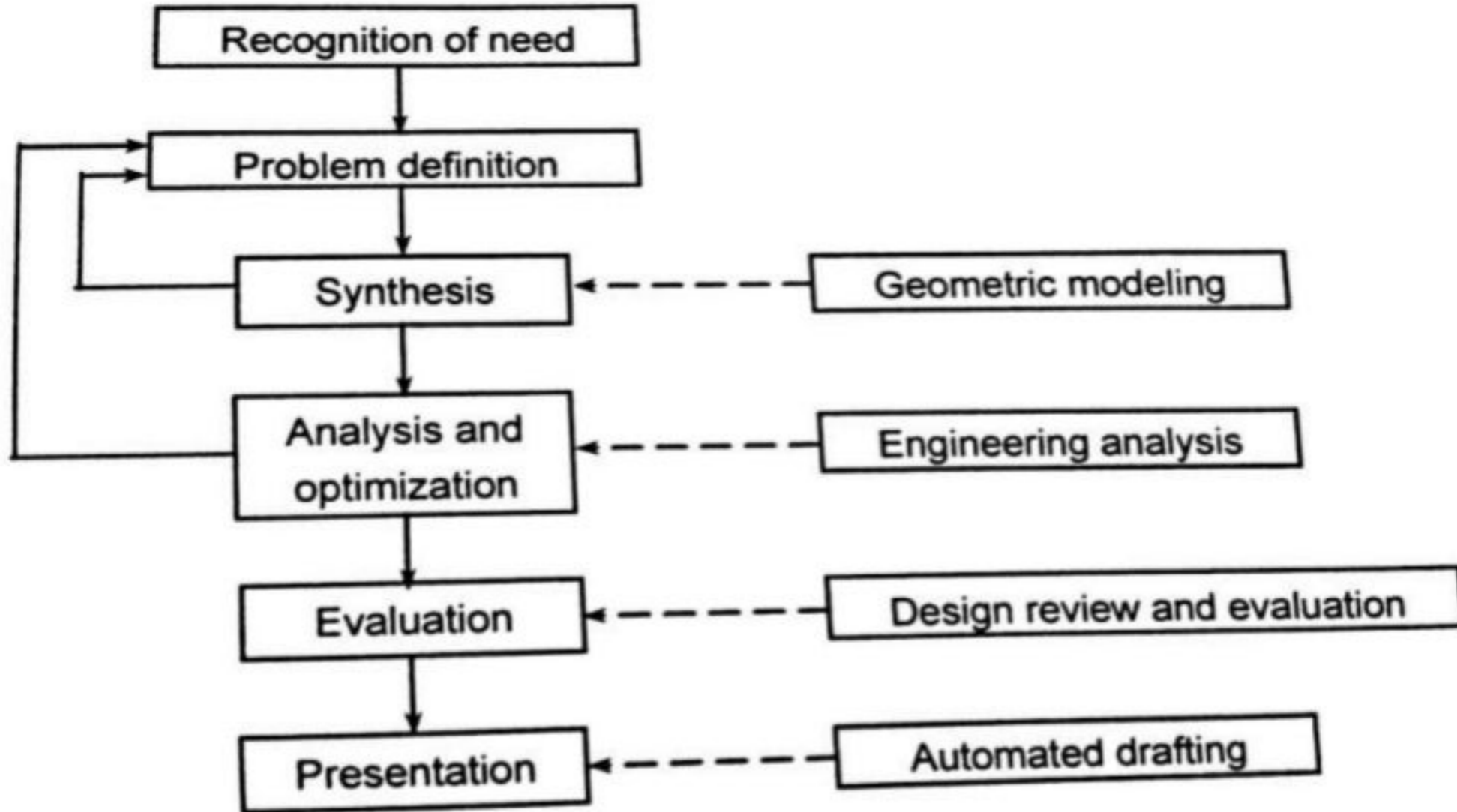
# Roles of CAD in Design

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- ❖ It records and recalls information with consistency and speed
- ❖ Use of Product Data Management (PDM) systems can store the whole design and processing history of a certain product for future reuse and upgrade.

*Convention design process*

*Computer aided design*



*Figure 1.13 CAD process*

# APPLICATION OF CAD

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- ❖ Mechanical engineering
- ❖ Civil engineering
- ❖ Electrical and electronics engineering
- ❖ Textile industry

# ADVANTAGES OF CAD

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- ❖ Easy editing
- ❖ High quality
- ❖ Compact storage
- ❖ 3D Drawing