[Module-I]

Product design - product design considerations, product planning, product development, value analysis, product specification, Role of computer in product design.

Process planning - selection of processes, machine and Tools. Design of sequence of operations, Time and cost estimation.

Introduction of product design.

- product are the output of any production process having physical existance.
- During development of a product, design is the foundation stage.
- Design may be defined as the process of decision making by the group of technical personnel, considering different functional, economical and ergonomical aspects of product to satisfy the requirements.

product design may be grouped into 3 groups.

(1) Adoptive design.

→ A product is designed base upon the existing product's technical feature with a very minor modification.

(2) Development design

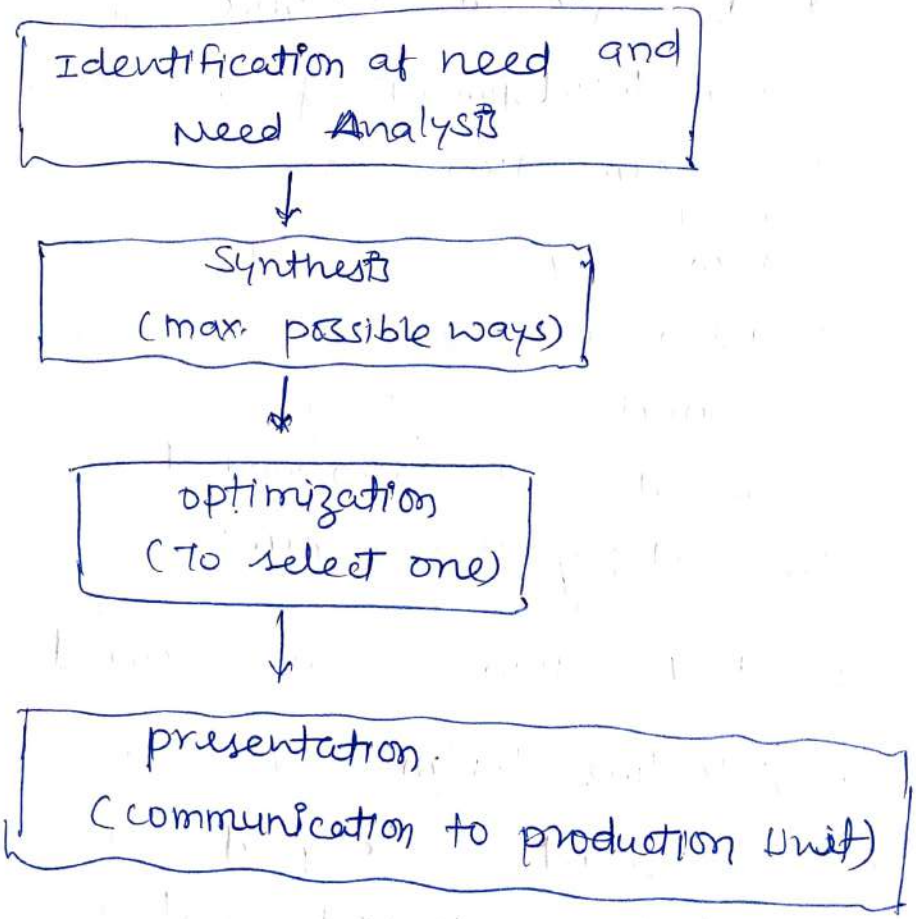
This Type of design process develops the product

taking base as existing product through analysing and implementing creativity and scientific thoughts which gives the result at a higher acceptable version of existing product.

(3) Innovative design

→ It is the representation and implementation of the designer's innovative idea and scientific thoughts to bring out a product which was never existed before.

Flow chart of product design.



product design considerations.

During product design it is impossible to produce a product fullfilling all crieteria but it should fullfill two features.

1. Customes satisfaction.

→ It should fulfil functional requirement
→ It should posses the dimensional accuracy.
→ It should be reliable.
→ It should have pleasant appearance.
→ It should have reasonable price without compromising in quality.

2. An adequate profit

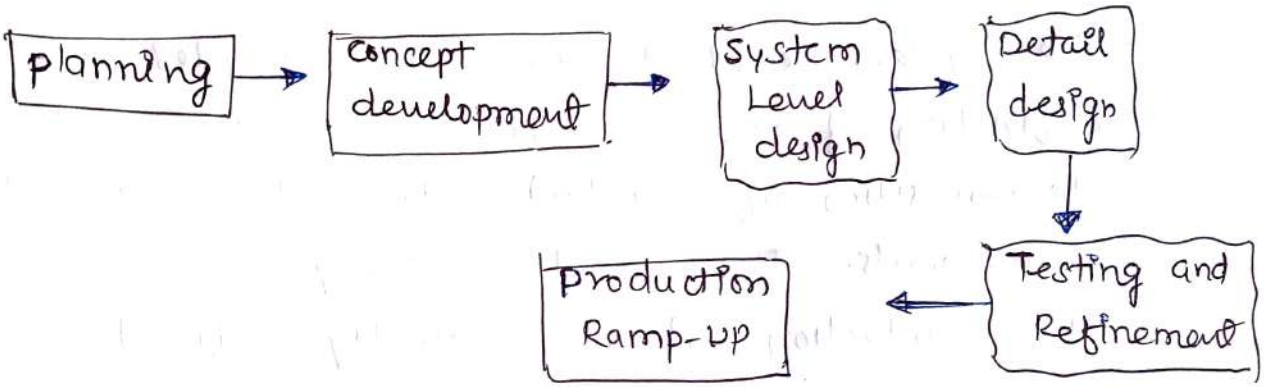
→ profit can be made by minimizing the cost
→ To minimising product cost following factors should be considered
  → product should be produced with in limited available resources.
  → production should be on mass scale to minimise fixed cost.
  → standard component parts should be adopted
  → production should be in minimum No. of operations and minimum manufacturing time

Product development process

A product development process is the sequence of steps or activities that an enterprise employs to conceive, design and commercialize a product.

Many of these steps and activities are intellectual and organizational rather than physical.

Six phases of the generic development process are -



1. planning

The planning activity is often referred to as "phase zero" because it precedes the project approval and Launch of the actual product development process.

The output of the planning phase is the project mission statement, which specifies the target market for the product, business goals, key assumptions and constraints.

2. concept development

In concept development phase, the need of the target market are identified, alternate product

one or more concept are selected for further development and testing.
A concept is a description of the form, function and features of a product and it is usually accompanied by a set of specification, an analysis of competitive products and an economic justification of product.

3. System Level design

The system Level design phase includes the definition of the product Architecture and the decomposition of product into subsystem and components. The final assembly scheme for the production sytem is usually defined during this phase. The output of this phase usually includes a geometric Layout of the product, a functional specification of each of the product's subsystem.

3. Detail design.

The detail design phase includes the complete specification of the geometry, material, and tolerances of all of the unique parts in the product and the identification of all of the standard parts to be purchased from suppliers. The output of this phase is the complete documentation for the product as the drawings or computer files describing the geometry of each part and Tooling for production.

Two critical issues addressed in the detail design phase are production cost and robust performance.

4. Testing and Refinement

Testing and Refinement phase involves the construction and evaluation of multiple pre-production versions of the product. Early (alpha) prototypes are usually built with parts having same geometry and material properties as intended for production version of the product but not necessarily fabricated with actual processes to be used in production. These product prototypes are tested to determine whether the product will work as designed and whether the product satisfies the key customer needs.

5. production ramp-up

In this phase, the product is made using the intended production system. The purpose of the ramp-up is to train the work force and to work out any remaining problems in the production processes. product produced during production ramp-up are sometimes supplied to preferred customers and are carefully evaluated to identify any remaining flaws.

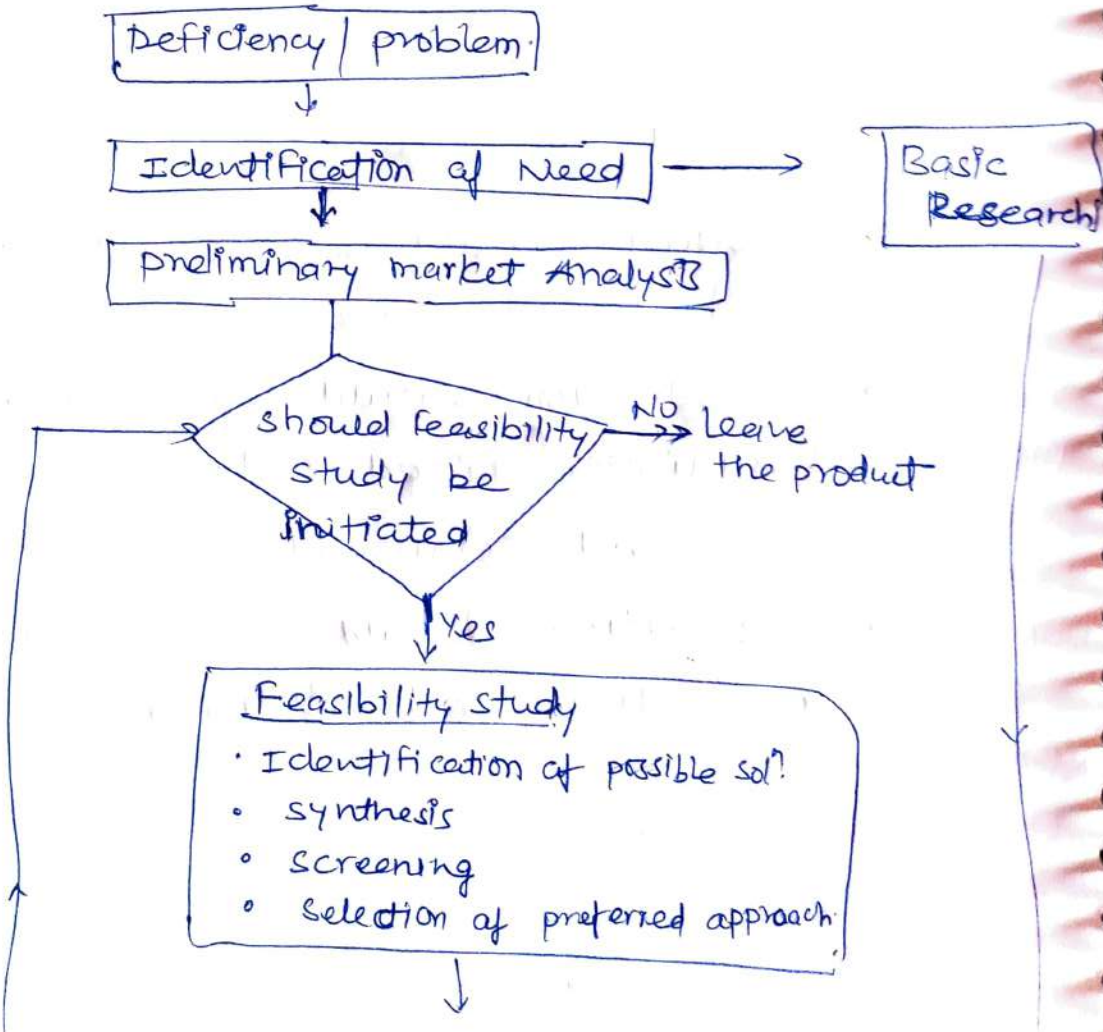
product planning

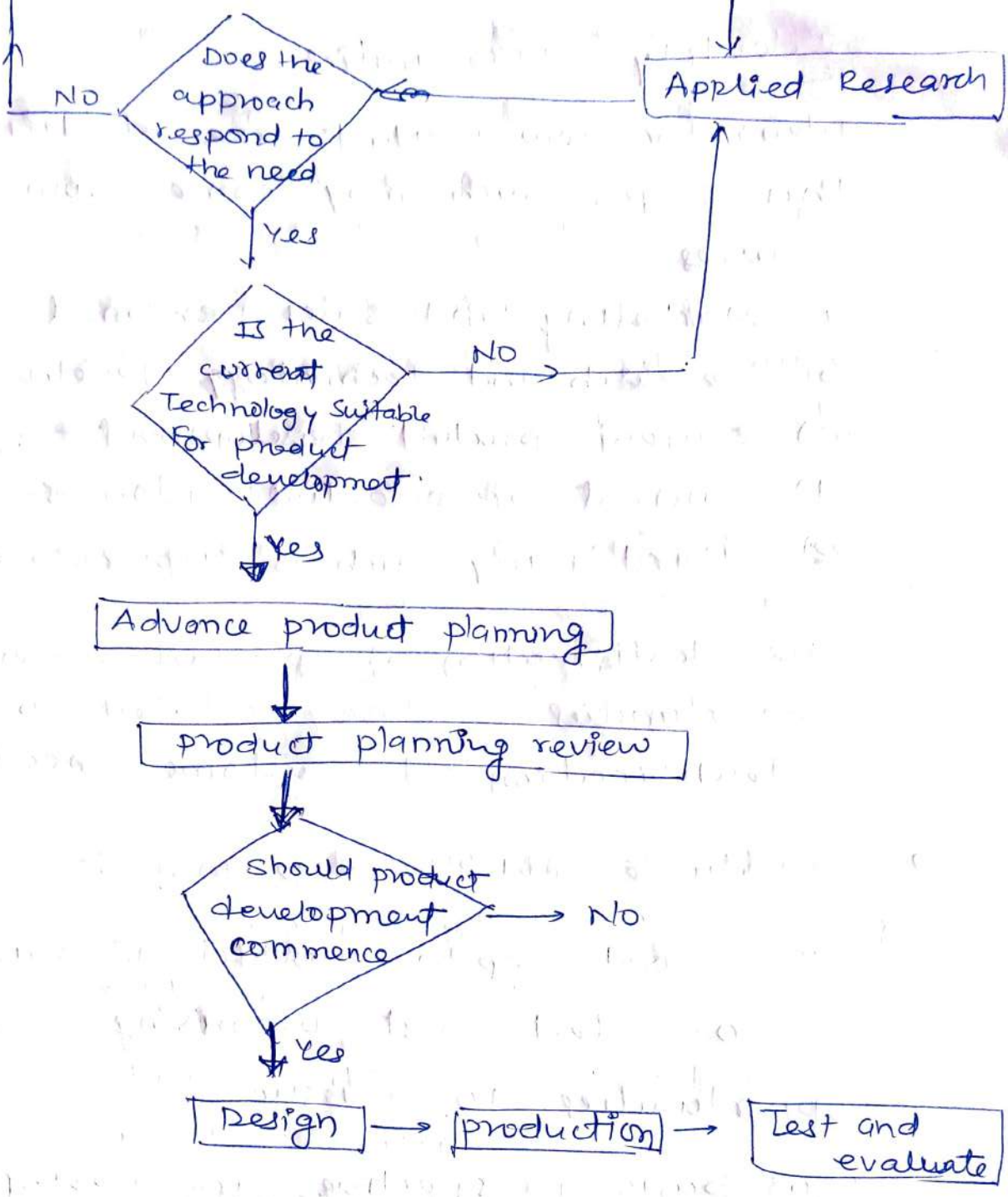
→ product planning is defined as the act of marking out and supervising the need analysis development and commercialization of new products, also modification of existing product and remove non-profitable product from company's activities.

product planning function often includes.

(1) Marketing and marketing analysis.
(2) The performance feasibility study.
(3) Advance planning.
(4) over all component planning.

flow chart of product planning process.





⇒ To develop a product plan and project mission statements, a five step process is followed.

1. Identify the opportunities
2. Evaluate and prioitize projects
3. Allocate Resources and plan timing.
4. Pre project planning.
5. Reflect on results and the process.

1. Identify opportunities.

Ideas for new product are identified in this step, which may come from several sources:

(a) Marketing and sales personnel.
(b) Research and Technology development organizations
(c) current product development teams.
(d) current or potential customers.
(e) Third party such as suppliers, Business partners

The identification of product development opportunities is closely related to the identification of customers needs.

2. Evaluate and prioritize projects:

The second step in product planning process is to select most promising projects or opportunities to pursue.

Four basic perspectives are useful in evaluating and prioritizing opportunity for new product which are competitive strategy, market segmentation, technological trajectories and product platforms.

Competitive strategy includes technology leadership, cost leadership, customer focus. Customer can be thought of as belonging

to distinct market segments. Dividing a market into segments allows the firm to consider the actions of competitors and the strength of the firm's existing products with respect to each well defined group of customers. By mapping competitor's products and the firm's own products into segments, the firm can assess strengths and weaknesses. In technology intensive business, a key product planning decision is when to adopt a new basic technology in a product line.

3. Allocate Resources and plan timing

It is likely that the firm can not afford to invest in every product development opportunity in its desired balanced portfolio of projects determing the timing and the sequence of projects, sometimes called pipeline management. It must consider a no. of factors as timing of product introduction, technology readiness, Market readiness, competitive environment etc.

The set of projects approved by the planning process, sequenced in time, becomes the product plan.

4. complete pre project planning.

once the project has been approved, but before substantial resources are applied, a pre project planning activity takes place. This activity involves a small cross functional team of people often known as the core team. The core team consist of approx 30 people representing a wide range of technical expertise, marketing, manufacturing and service functions.

A product mission statement is prepared. This statement includes brief description of product, Benefit proposition, key business goals, target market for product.

The pre project planning activity generally addresses project staffing and leadership. This may involve getting key members of the development staff to sign up for a new product or project.

Budgets are also generally established during pre project planning.

5. Reflect on results and the process.

In this final step of planning and strategy process, the team should ask several questions to asses the quality of both the process and results, which are -

(a) Does product plan support the competitive strategy of the firm.

(b) Does the product plan address the most important current opportunities facing the firm.

(c) Are the elements of the mission statement consistent.

(d) How can product planning process be improved.

Product Specification.

Product specification is a set of information about a product which may include identification symbols or codes of manufacturer, a list of rules, process through which it has been produced. It can also be stated as standardised process of documented feature by virtue of which any body can easily distinguish or identify it.

Product specification acts as a screening tool for Inventory point of view, where as from product designer point of view it provides information about the customer's requirement. So during design product specification provides foundation and basis of product development.

The development of product specification includes following steps.

1. preparation of list of matrics.
2. collect competitive bench marking information
3. Set ideal and marginally acceptable target values.
4. Reflect on results and process.
5. Setting the Final specification.

1. Preparation of List of metrics

The most useful matrics are those that reflects as directly as possible the degree to which the product satisfies the customer needs.
The working assumption is that a translation from customer needs to a set of precise, measurable specifications is possible and that meeting specification will therefore lead to satisfaction of the associated customer needs.

2. Collect competitive bench marking information.

Unless the team expects to enjoy a total monopoly in market over its competitive products, the commercial success of product is not possible. when a team enter the product development process with some idea of how it wishes to compete in market; the target specification are the

Language of the team for discussion. The team collects the information of their competitive product and compare the new product's specification ~~and~~ with both the already existing product of their competitors and with their own product.

3. Set Ideal and Marginally acceptable Target values

In this step, the team synthesizes the available information in order to actually set the target values for the specifications. There are two type of target values - an Ideal value and a marginally acceptable value. The ideal value is the best result the team could hope for. and the marginally acceptable value is the value of the metric that would just enough to make the product commercially viable. Both of these target are useful in guiding the subsequent stages of concept generation, ~~and~~ concept selection and for refining the specification after the product concept has been selected.

4. Reflects on the results and the process

The Team may require some iteration to agree on the targets. Reflection after each iteration helps to ensure that the results are consistent with the goals of the project.

5. Setting the Final specification

As the team finalised the choice of a concept and prepares for subsequent design and development, the specifications are revisited. Specifications which originally were only targets expressed as broad range of values are now refined and made more precise.

Value Analysis

Value of a product is the performance and capability of that product relative to its cost.

$$\text{value} = \frac{\text{function}}{\text{cost}} = \frac{(\text{performance} + \text{capability})}{\text{cost}}$$

The concept of increasing value of a product is not only to minimise the cost but also to increase function and performance.