

School of Mechanical Engineering

Course Code : MCDM5004

Course Name: Product Design and Life cycle Management

UNIT II

PRODUCT DESIGN AND LIFE CYCLE MANAGEMENT-EARLY DESIGN

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EARLY DESIGN

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BEST PRACTICES FOR TRADE-OFF ANALYSIS

- **Systematic decision making process** that addresses all possible impacts of various design decisions.
 - **Design improvements** are identified and implemented through an action-oriented approach.
 - **Models** are accurate and based on a **realistic assessment** of user needs, market requirements, product performance, manufacturing capabilities, prototypes, logistics, and other factors.
 - **Parameters** used in the model are **up-to-date, accurate**.
- **Design to Cost** aggressively lowers product costs in order to increase sales and profit.
- **Life Cycle Cost** models are used for in-depth trade-off studies of design, manufacturing, operation, maintenance, logistics, environmental, and warranty parameters to improve the design.

SYSTEMATIC TRADE-OFF ANALYSIS PROCESS

➤ **Analysis** is a technique for gathering additional information in order to make **better design decisions** for improving the design.

➤ All analyses **need to address the possible impacts** of their results on other areas/disciplines in **product development**. This includes all aspects of a product at the **appropriate level of detail**. The **steps** of a successful trade-off analysis procedure at one company are to develop:

- **Clear problem statement**
- **Identification of requirements that must be achieved**
- **Ground rules and assumptions**
- **Decision criteria**
- **Schedule**
- **Potential solutions and screening matrix**
- **Comprehensive array of feasible alternatives**
- **Comparisons of alternatives using decision criteria**

TRADE-OFF ANALYSIS MODELS AND PARAMETERS

- Models provide information to the design team. The quality of the model and its parameters determines the quality of the information provided.
- Models and their parameters need to be accurate, up to date and based on a realistic assessment of user needs, market requirements, product performance, manufacturing and support capabilities, prototypes, logistics, and other factors.
- Good models provide quality information that reduces technical risk and are cost effective, accurate, and timely. The best model depends on the application and the resources and time available.

DESIGN TO COST

- A technique aimed at reducing or minimizing a product's price or cost, which results in increasing sales volume. This analysis focuses on the **need to reduce a product's purchase price**.
- Reduction of product cost is accomplished through a rigorous approach of **identifying and implementing cost reducing design and manufacturing improvements**.
- There are **three steps** in developing an effective DTC program:
 1. **Determine critical product price goals** or targets using market elasticity research for various levels of sales.
 2. Establish **realistic product cost goals** based on projected sales volumes and learning curve improvements in design and manufacturing that accomplish the established product price goals.
 3. **Reduce costs to meet these cost goals** through an action-oriented approach using **trade-off studies**.

DESIGN TO LIFE CYCLE COST

- Life cycle cost (LCC) is a discipline that develops a model of the total cost for acquisition, operation, maintenance and disposal of a product over its full life to use in design trade-off studies.
- The model is used for analytical trade-off studies, identifying overall cost of a product and predicting future costs of maintenance, logistics, and warranties.
- A major decision to be made when using cost metrics is the types of costs to include, length of time for the study, and the cost of money i.e. inflation in the study.
- An effective effort requires a realistic LCC model, valid input data, extensive design trade-off studies, and the implementation of design improvements identified in the trade-off analyses. The limitations of the model are as important as its strengths.

There are three steps in developing effective life cycle cost models for design trade-offs.

1. **Develop cost models** that accurately describe the costs associated with a product.

- a. Define parameters and collect data

- b. Develop LCC model (parametric or accounting)

- c. Perform baseline analysis using the model

2. **Perform verification analyses, trade-off analyses** and identify cost drivers.

- a. Vary LCC model inputs and iteratively evaluate its effects to

- b. Perform trade-off analyses

- c. Identify design improvements

3. **Reduce costs** to meet these goals through an action oriented approach using design trade-off studies.

- a. Implement improvements

References

1. Karl T. Ulrich and Steven D. Eppinger (2009), Product Design and Development, 4th Edition, Tata McGraw-Hill Publishing Company Limited, ISBN: 978-0-070-14679-2
2. Stephen C. Armstrong (2005), Engineering and Product development Management– The Holistic Approach, Cambridge University Press, ISBN: 978-0-521-01774-9.
3. Thomas A. Sabomone, (1995), What every engineer should know about concurrent engineering, Marcel Dekker Publications, ISBN- 978-0-824-79578-8.

The logo of Galgotias University is a circular emblem with a stylized 'G' shape. It features three curved segments in shades of yellow, light blue, and light red, set against a light pinkish-red background.

Thank you

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