

Module 1: Introduction and Basic Concepts

Learning Objectives

Optimization is the act of obtaining the best result under the given circumstances. In design construction and maintenance of any engineering system, many technological and managerial decisions have to be taken at several stages. The ultimate goal of all such decisions is either to minimize the effort required or to maximize the desired benefit. Hence optimization can be defined as the process of finding the conditions that give the minimum or maximum value of a function, where the function represents the effort required or the desired benefit.

This module starts with a glance through the historical development of optimization methods. Engineering applications of optimizations are scanned through from which one would get a broad picture of the multitude of applications, the optimization methods have. The Art of modeling is briefly explained with the various phases involved in modeling. In the second lecture various components of the Optimization problem are discussed and summarized with steps involved in formulating a mathematical programming problem. In the third lecture the optimization problems are classified under various criteria to enable choosing an appropriate model applicable to different types of optimization problems. In the final lecture a brief introduction to the classical and advanced optimization techniques in use are given.

At the end of the module the reader will be able to

1. Understand the need and origin of the optimization methods.
2. Get a broader picture of the various applications of optimization methods used in engineering.
3. Define an optimization problem and its various components.
4. Formulate optimization problems as mathematical programming problems.
5. Classify optimization problems to suitably choose the method needed to solve the particular type of problem.
6. Briefly learn about classical and advanced techniques in optimizations.