

Industrial Engineering and Operations Research (MEC 3411)

- Course Number : MEC3411 edits : 4
- Course Category : DC
- Pre-requisites(s) : None
- Contact Hours : 3L- 1T- 0P
- Type of Course : Theory
- Course Assessment: Course Work 15%
Internal Exam (1hr) 25%
End Sem Exam (2hrs) 60%

- Objectives

- To design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments.
- Prepare students to adapt and solve the increasingly complex problems faced by industry, embrace innovation through intellectual diversity and creative problem solving.
- Apply various operations research tools to solve real life industry problems.

- Course Outcomes

- After taking this course students should be able to:
 - Evaluate productivity models in various industries. Apply knowledge of product development and industrial process design. Analyse the facility locations. Control the quality of an end product. Understand supply chain management, MRP and quality control techniques and measures.
 - Apply knowledge of mathematical models and optimization techniques to various industries-based problems.
 - Comprehend and understand the project management. Apply knowledge of reliability and non-linear programming concepts for real life industry problems.

Syllabus

- **Unit-1:** Overview of Industrial Engineering, Productivity and its measurement, Product development, Facility location and layout, group technology.
- **Unit-II:** Scheduling systems, capacity planning, aggregate planning, supply chain management, deterministic Inventory Models, Material Requirement Planning (MRP), Quality Control
- **Unit-III:** Introduction to Optimization, Linear Programming (LP) and its Canonical and Standard Forms, Simplex Method, Duplex Method, Linear Goal Programming, Transportation and Assignment Models.
- **Unit-IV:** Project management, Queuing Models, Decision Theory, Reliability and Non-linear Programming.

Books

- Adam, B.E. & Ebert, R.J. 'Production and Operations Management' PHI
- F.S. Hillier & G.J. Lieberman, Operations Research, Tata McGraw Hills, New York.
- Riggs J.L. 'Production Systems Analysis and Control' John Wiley & Sons
- Groover, M.P. 'Automation, Production Systems & Computer Integrated Manufacturing' PHI

What is Optimization?

- Choosing the best element from some set of available alternatives
- Solving problems in which one seeks to minimize or maximize a real function

Operations Research

- Deals with **practical management of the organization**: conducting and coordinating operations/activities within an organization
- Uses the **systems approach**: Resolves conflict of interest among the organizational components to arrive at **the** optimal solution
- May be applied to **any organization** e.g. manufacturing, transportation, construction, telecommunications, financial planning, health care, military, public services

Phases of Study

- Define problem of interest and gather relevant data
- Formulate its mathematical model (idealized representation)
- Develop a procedure (computer based) for solving it
- Post Optimality analysis E.g. sensitivity analysis
 - Sensitivity analysis identifies sensitive parameters viz. parameters whose value cannot be changed without changing the optimal solution
- Test the model and refine it if needed: E.g. retrospective testing
- Prepare for its application: Development of computer-based programs for long term use
- Implement

Components of an Optimization Problem

- Objective function expresses the main aim of the model which is either to be minimized or maximized.
- Set of unknowns or variables which control the value of the objective function.
- Set of constraints that allow the unknowns to take on certain values but exclude others.
 - Optimization problem is then to:

Find values of the variables that minimize or maximize the objective function while satisfying the constraints.

Complicating Factors in Optimization

- Existence of multiple decision variables
- Complex nature of the relationships between the decision variables and the associated income
- Existence of one or more complex constraints on the decision variables

Classification of Optimization

