EASTERN MEDITERRANEAN UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF INDUSTRIAL ENGINEERING

IENG531 - Production Planning and Scheduling

Year and Semester: 2024-2025 Spring
Credit Hour : (3, 0)3
Pre-requisite(s) : Graduate standing and consent of the instructor.

Lecturer

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Catalog Description

Analysis of some specific problem areas within the context of planning and scheduling of production activities. Definition, formulation and available solution procedures for aggregate planning, lot sizing, material requirements planning, cutting stock, line balancing, single processor scheduling, multi processor scheduling problems are studied.

Aims and Objectives

To provide a thorough understanding of how to model production planning and scheduling problems as well as the solution algorithms. To enhance the students with the ability of reading mathematical proofs. To give an understanding of combinatorial problems, convergence of algorithms, and computational complexity. To emphasize the application areas of nonlinear programming. To teach the students how to read a mathematical paper and how to summarize it to an audience in simple terms.

GENERAL LEARNING OUTCOMES

On successful completion of this course, all students will have developed **knowledge** and **understanding** of:

- Production planning problems and short, medium, and long term decision making
- Features of hierarchical production planning
- Use of mathematical models as optimization tools for solving production planning problems
- Aggregate planning and related solution procedures
- Lot-sizing and requirements planning
- Models of machine scheduling (deterministic vs stochastic, static vs dynamic, flow shop vs job shop, and so on) and associated assumptions
- Assembly line balancing
- Algorithms for combinatorial problems
- Computational complexity of scheduling problems
- Polynomial time algorithms and the theory of NP-completeness
- Recent developments in production planning and scheduling fields

On successful completion of this course, all students will have developed **their skills in**:

- Developing appropriate mathematical models that can be applied in production planning decision making process and solving them
- Classifying, modeling and solving machine scheduling problems
- Reading, understanding, and presenting recent research in the fields of production planning and machine scheduling
- Pursuing other graduate level courses that involve production planning and scheduling issues

On successful completion of this course, all students will have developed their **appreciation** of, and respect for **values and attitudes** to:

- Understand the importance of human element in decision making
- Consider limitations of the analyses by taking into account the realistic practical constraints such as environmental, social, political and ethical
- Understand the impact of engineering solutions in global and societal context
- Professional and ethical responsibilities of engineers

Prerequisite by Topic

Optimization and Modeling. Linear Programming and Non-linear Programming formulations. Integer and 0-1 Programming. Dynamic Programming. Multi-objective problems. Basic fundamentals of Production Planning and Scheduling.

Textbooks

L.A. Johnson and D.C. Montgomery, *Operations Research in Production Planning, Scheduling and Inventory Control*, Wiley, 1974.
E.A. Silver, D.F. Pyke, and R. Peterson, *Inventory Management and Production Planning and Scheduling*, Wiley, 1998.
M. Pinedo, *Scheduling: Theory, Algorithms and Systems* (2nd ed.), Prentice-Hall, 2002.
S.C. Graves, A.H.G. Rinnooy Kan and P.H. Zipkin (editors), *Handbooks in Operations Research and Management Science, Vol.4, Logistics of Production and Inventory*, Elsevier, 1993.

Computer Usage

Students should be able to use packages such as *LINDO*, *CPLEX* etc. which will be required for homework assignments.

Grading Policy

HW Assignments	20 %
Midterm	30 %
Paper presentation	20 %
Final	30 %

Presentation Hours

Presentation hours will be scheduled later.

Course Outline

Weeks 1 - 3 Overview of Production Planning Basics
Typical features of production planning problems. Decision making in production planning. Short-term, medium-term, and long-term planning. Hierarchical production planning. Overview of mathematical models and optimization tools.

Weeks 4 - 8 Production Planning Models and Algorithms
Aggregate planning. LP models for aggregate planning. Transportation Model approach to production planning problems. Minimum cost flow network models for production planning. Non-linear cost functions. Dynamic Programming approach. Wagner-Whitin principle for lot-sizing decisions. Zangwill's extension to models which include backlogging. Requirements planning and lot-sizing.

Weeks 9 Algorithmic Complexity
Algorithms for combinatorial problems. Computational complexity. Polynomial time algorithms and the theory of *NP*-completeness.

Weeks 10 - 12 Operations Scheduling
Overview of deterministic vs. stochastic and static vs. dynamic models of scheduling. Integer programming models of single machine problems, algorithms and heuristics. Parallel machine models. Deterministic flow-shop and job-shop models. Assembly-line balancing: Formulation and heuristics.

Weeks 13 - 14 Paper Presentations
Each student is required to find an appropriate article on a related topic, get the approval of the instructor, and give a detailed presentation in the class. It is of utmost importance that the student has had an in-depth understanding of the article to convey it to the audience. It is also expected from the student to suggest further research directions.

ACADEMIC HONESTY - PLAGIARISM

Cheating is copying from others or providing information, written or oral, to others. Plagiarism is copying without acknowledgement from other people's work. According to university by laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project, to more serious action (letter of official warning, suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts.