



**National Institute of Technology Jamshedpur**  
**Jamshedpur - 831 014, JHARKHAND**  
**Department of Production and Industrial Engineering**

Spring Semester

Course Handout

Batch: B. Tech. VI<sup>th</sup> Semester

Course code: PI1603

Course Title: Operations Research

Session 2020-2021

Date: 07/01/2021

Department: P&I Engg.

Credits: 4-0-0

Faculty- in-Charge: Dr. Kanika Prasad

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**Course Description:**

**Unit I: Operations Research:** Scope and application of operation research. Linear programming, graphical and simplex method. Special cases in linear programming problems. Duality in linear programming.

**Unit II: Specially structured linear programming problems:** Transportation - North west corner method, Least cost method, Penalty method. Methods for optimality check - Modified distribution (MODI) method, Vogel's approximation method (VAM), Assignment models - Hungarian method, Dynamic programming.

**Unit III: Project Management:** CPM, PERT, Cost Crashing of Network.

**Unit IV: Inventory Management:** Inventory Management and Function Model (deterministic) and Price Breakup, Queuing theory (single and double channel). Sequencing models (n jobs - 2 machines, n jobs - 3machines),

**Unit V:** Replacement problems, Game theory (competitive strategies), Non-linear programming (Kuhn-Tucker condition), Simulation and Monte-Carlo techniques.

Text and Reference Books

1. Problem in Operation Research (Principles & Solution), D S Hira, Prem Kumar Gupta)
2. Operations Research, Swarup by Kanti Swarup, P. K. Gupta, Man Mohan
3. Quantitative Techniques in Management, N. D. Vohra

**Scope:**

The course aims at providing the basic concepts associated with Operations Research. Principles of Linear models of Optimization, Principles of basic Inventory Management Techniques, Project Management techniques. Simulation

**Objectives:**

- To provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.
- To introduce some widely advanced operations research models. The understanding of these models should allow communication with persons who run them and to evaluate the results presented.
- To provide advanced tools that can be used to solve such management problems.

**Course outcomes:**

PI1603.1 Students will underline the fundamental concept of operations research.

PI1603.2 Students will understand optimization models

PI1603.3 Students will apply basic techniques for Project management.

PI1603.4 Students will apply basic inventory management techniques and queuing models.

PI1603.5 Students will learn application of competitive strategies and simulation.

### Text Books

- T1 M. Mahajan, Industrial Engineering and Production Management, Dhanpat Rai & Co.  
T2 H. A. Taha, Operation Research: An Introduction, 9<sup>th</sup> ed. PHI, New Delhi.  
T3 B Mahadevan, Operations Management - Theory and Practice, Pearson  
T4 Problem in Operation Research (Principles & Solution), D S Hira, Prem Kumar Gupta)  
T5 Quantitative Techniques in Management, N. D. Vohra

### Course articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME502.1	3	3	3	2	2				1	3	3	3
ME502.2	3	3	3	2	2				1	3	3	3
ME502.3	3	3	3	2	2	1			2	3	3	3
ME502.4	2	2	3	3	3	3	2	1	3	3	2	3
ME502.5	2	2	3	2	3	3			2	3	1	3
<b>AVG</b>	<b>2.6</b>	<b>2.6</b>	<b>3</b>	<b>2.2</b>	<b>2.4</b>	<b>1.4</b>	<b>0.4</b>	<b>0.2</b>	<b>1.8</b>	<b>3</b>	<b>2.4</b>	<b>3</b>

### Course Plan

Lecture No.	Learning Objectives	Topics to be covered	Reference
1	Introduction to OR	Introduction and Basic Definitions of Terms used in OR	T1 ,T2
2-10	Formulating and solving Linear Programming Problems	Graphical Method, Simplex, Big-M, Dual Simplex Algorithms, Duality Theory	T1 ,T2
11-18	Solving Transportation and Assignment Problems	North West Corner Rule, Least Cost Rule, Vogel's Approximation Method for Transportation Models, Assignment problems	T1 ,T2
19-20	Dynamic Programming	Dynamic Programming	T3
21-24	Modeling and solving Queuing problems	Derivations and Problems of Models for Single Server Queues, Sequencing	T1 ,T2
25-30	Inventory Management	Modelling and Solving Inventory related problems	T1 ,T2
31-35	Project Management	CPM, PERT, Cost Crashing of Network,	T3
36-37	Competitive strategies	Replacement problems, Game theory	T3
38	Non-Linear Programming	Kuhn-Tucker condition	
39	Simulation	Monte-Carlo techniques	T3

### Evaluation Scheme

Sl. No.	Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
1.	Mid sem	2 Hrs.	30%	Refer to Academic calendar	Closed Book
2.	End Semester exam.	3 Hrs.	50%		Closed Book
3.	Teacher's assessment (Attendance + Quiz + Assignment)		20%	Quiz - Any scheduled class	Assignment - take home

**Consultation Hours:** 4pm to 6pm (Monday to Friday) G08-07, New Academic Building.

**Note:** All notices regarding the course will be displayed only on the Department of Production and Industrial Engineering notice board.

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