

OPERATIONS RESEARCH

(PROFESSIONAL ELECTIVE-I)

Course Code: 19ME1153

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Course Outcomes: At the end of the course, the student will be able to

CO1: Explain concepts of optimization and linear programming

CO2: Solve transportation and assignment tasks / problems

CO3: Determine the optimal sequence of performing the jobs and make decisions on replacement of items in industrial environment

CO4: Discuss the characteristics of queue and use the concepts in inventory maintenance

CO5: Determine the project completion time by using CPM and PERT techniques

UNIT- I

10 Lectures

Introduction to Operations Research.

Linear Programming Problem, linear programming, mathematical formulation of the problem, graphical solution, simplex method: introduction, computational procedure, use of artificial variables – Big M method.

Learning Outcomes: At the end of this unit, the student will be able to

1. explain concepts of optimization, modelling and linear programming (LP) (L2)
2. solve LP models using graphical method and simplex algorithm (L3)
3. differentiate between the basic feasible solution and optimal solution (L2)

UNIT- II

10 Lectures

Assignment Model: mathematical formulation of assignment problem, Hungarian assignment method, special cases in assignment problems, travelling salesman problem.

Transportation model: LP formulation for transportation problem, transportation table, solution of transportation problem, finding initial basic feasible solution (IBFS): north-west corner rule, least cost method and Vogel's approximation method (VAM), test for optimality and degeneracy in transportation model.

Learning Outcomes: At the end of this unit, the student will be able to

1. solve assignment model using Hungarian assignment method (L3)
2. determine optimal cost of commodity for its transfer solving transportation problem (L3)
3. determine the IBFS for transportation problem using north-west corner rule and Vogel's approximation method (L3)

UNIT- III

10 Lectures

Game Theory: Introduction, two person zero sum games, maximin – minimax principle, game without saddle points, mixed strategies, graphical solution of $2 \times n$, $m \times 2$ games, and dominance principle.

Sequencing Problem: Introduction, problem of sequencing, processing n jobs through two machines, n jobs through three machines.

Replacement Problem: Replacement of items that deteriorate gradually, replacement of items that fails suddenly, individual replacement policy, group replacement policy.

Learning Outcomes: At the end of this unit, the student will be able to

1. solve the zero-sum two- person games, using maximin and minimax approach (L3)
2. explain the assumptions made while solving sequencing problem in handling various jobs through multiple machines (L2)
3. determine the best policy to be adopted to replace the equipment in industry (L3)

UNIT- IV

10 Lectures

Queuing Theory: Introduction, queuing system, elements of queuing system operating characteristics of a queuing system, classification of queuing models: Model-I (M/M/1: ∞ /FIFO), model-II (M/M/1: N/FIFO)

Inventory Control: Introduction, types of inventories, costs associated with inventories, the concept of Economic order quantity (EOQ), deterministic inventory problems with no shortages, with shortages. always better control (ABC) method, vital essential and desirable (VED) method and XYZ method.

Learning Outcomes: At the end of this unit, the student will be able to

1. describe the queuing models for understanding the behavior of waiting lines (L2)
2. determine EOQ in inventory control through necessary assumptions (L3)
3. explain ABC, VED and XYZ inventory control methods (L2)

UNIT- V

10 Lectures

Network analysis: Introduction, basic steps in CPM and PERT techniques, network diagram representation, rules for drawing network diagram, Fulkerson's rule for labelling, time estimates and critical path in network analysis, optimum duration and minimum duration cost, project evaluation and review technique (PERT) of the project.

Learning Outcomes: At the end of this unit, the student will be able to

1. describe the construction of network diagram for project evaluation and analysis (L2)
2. determine the duration of project through networks analysis using CPM (L3)
3. determine the optimum cost of the project using PERT (L3)

Text Books:

1. Kanti Swarup, P. K. Gupta, and Manmohan, *Operations Research*, 12th Edition, S. Chand & sons, 2004. (Units- I and II)
2. S D Sharma, *Operations Research*, 8th Edition Kedarnath Ramnath Publishers, 2008. (Units- III, IV and V)

Reference Books:

1. Manohar Mahajan, *Operations Research*, 5th Edition, Dhanpat Rai & Co. (P) Limited, 2016.
2. A M Natarajan, P Balasubramani, ATamilarasi, *Operations Research*, Pearson Education Publishers, 2005.
3. F S Hillier, G J Lieberman, *Introduction to Operations Research*, 9th Edition, TMH Publications, 2010.
4. H. A. Taha, *Introduction to Operations Research*, 8th Edition, PHI Publications, 2008.
5. J K Sharma, *Operations Research*, 4th Edition, Macmillan India Limited, 2009.