Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Third Year Bachelor of Engineering (IT)

(In Effect from Academic Year 2019-20)

Subject Code: IT604H-N	**Subject Title:** Operational Research
Pre-requisite	

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
03	00	02	05	04	03	70	30	20	30	150

Course Objective:

- Learn to formulate a real-world problem into mathematical programming model.
- Learn to use Excel and other Operation Research (OR) tools to solve mathematical programming models.
- Understand the Linear Programming problem and its application in industry for optimized solution in terms of maximizing profit or minimization of cost
- Understand to solve OR problems both from primal and dual of Linear Programming problems
- Learn to model and solve dynamic programming, integer programming
- Capability to solve linear programming problems like transportation and assignment problems
- Learn to model a dynamic system as queuing model
- Understand and learn to solve network models like minimum spanning tree, shortest path and maximum flow problems

Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Introduction to Operations Research	4
2	Linear Programming Problem	10
3	Transportation Problem	3
4	Assignment Problem	3
5	Integer Programming Problem	4
6	Queuing Theory	6
7	Simulation	8
8	Project Scheduling and PERT-CPM	6
9	Game Theory	4

Total hours (Theory):48
Total hours (Lab):32
Total hours: 80

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Detailed Syllabus

Sr. No	Topic	Lecture Hours	Weightage(%)
1	**Introduction to Operations Research**: Introduction, Historical Background, Scope of Operations Research, Features of Operations Research, Phases of Operations Research, Types of Operations Research Models, Operations Research Methodology, Operations Research Techniques and Tools, Structure of the Mathematical Model, Limitations of Operations Research	4	8
2	**Linear Programming Problem**: Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical Methods to Solve Linear Programming Problems, Introduction , Standard Form of LPP, Fundamental theorem of LPP, Solution of LPP – Simplex Method, The Simplex Algorithm, Penalty Cost Method or Big M-method, Two Phase Method, Solved Problems on Minimization, Introduction,	10	21
3	***Transportation Problem:*** Introduction, Formulation of Transportation Problem (TP), Transportation Algorithm (MODI Method), the Initial Basic Feasible Solution, Moving Towards Optimality	3	6
4	***Assignment Problem:*** Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Routing Problem, Travelling Salesman Problem	3	6
5	***Integer Programming Problem:*** Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique	4	8
6	***Queuing Theory:*** Introduction, Queuing Theory, Operating Characteristics of a Queuing System, Constituents of a Queuing System, Service Facility, Queue Discipline, Mathematical Analysis of Queuing Process, Properties of Queuing System, Notations, Service System, Single Channel Models, Multiple Service Channels, Erlang Family of Distribution of Service Times, Applications of Queuing Theory, Limitations of Queuing Theory, Finite Queuing Models	6	13
7	**Simulation**: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	8	17

8	**Project Scheduling and PERT-CPM**: Introduction, Basic Difference between PERT and CPM, PERT/CPM Network Components and Precedence Relationship, Project Management – PERT	6	13
9	**Game Theory**: Introduction, Competitive Situations, Characteristics of Competitive Games, Maximin – Minimax Principle, Dominance	4	8
	Total	48	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

- On successful completion of this course, the student should be able to:
  1. Students will be able to describe characteristics and scope of OR.
  2. Students will be able to define and formulate mathematical problems.
  3. Students will be able to select optimal problems solving techniques for a given problem using LP.
  4. Students will be able to formulate and solve transportation and travelling sales man problems.
  5. Students will be able to formulate and solve optimization problems related to job/ work assignments.
  6. Students will be able to demonstrate and solve simple models of Game theory
  7. Students will be able to evaluate optimum solution using dynamic programming for different applications.
  8. Students will be able to choose / devise appropriate queuing model for practical application.
  9. Students will be able to solve different problems related to Network

Reference Books:

1. "Quantitative Techniques in Management", by N D Vohra,Tata McGraw-Hill.
2. "Operations Research: An Introduction", HamdyTaha, Pearson.
3. "Operations Research", A M Natarajan, P Balasubramani, A Tamilrasi, Pearson EducationInc
4. "Introduction to Operations Research", Hiller, Frederick S, Lieberman, Gerald J, 9th Edition, McGraw Hill Higher Education

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Practical List:

1	Familiarization with FORTRAN.
2	Linear Programming (Transportation, Assignment, Duality, Simplex) in Fortran.
3	Shortest path (Dijkstra's, Floyd's Algorithm) in C language.
4	Maximal Flow in C language.
5	PERT/CPM in C language.
6	Queuing Theory in C language.
7	Integer Programming Problem (Branch and Bound Problem) in C language.