AMITY UNIVERSITY
UTTAR PRADESH

Course Title: ADVANCED OPERATIONS RESEARCH **Credit Units: 06**
Course Level : PG **Course Code: POE604**

L	T	P/S (hrs)	SW/FW	TOTAL CREDIT UNITS
4	0	4	-	6

Course Objectives: This is an advanced course in OR. It aims at introducing the students to some operational research methods that are used in the systems approach to Engineering and Management, so as to provide them with the requisite tools for the mathematical representation of decision-making problems, in particular emphasising the roles of uncertainty and risk.

Pre-requisites: Knowledge of basic concepts of algebra and programming techniques

Course Contents/Syllabus:

	Weightage (%)
Module I: Integer Programming	**20%**
Descriptors/Topics 1. Introduction,types of Integer Programing Problems 2. Branch and bound algorithm. 3. Enumeration and Cutting plane methods for pure and mixed Integer programming problems, 4. Gomory's All Integer Cutting Plane Method,Gomory's Mixed Integer Cutting Plane Method 5. Applications of Zero-one Integer Programming, Knap-sack, travelling salesman and shortest route problems.	

Module II : Non-linear Programming	
Descriptors/Topics 1. Introduction, the general Non-Linear Programming Problem. 2. Constraint qualification and Kuhn-Tucker necessary conditions. Sufficiency of Kuhn-Tucker necessary conditions and convex programs 3. Linear Complementarity Problem (LCP) and Lemke's complementary pivot algorithm 4. Copositive plus matrices and Lemke's algorithm. 5. Quadratic programming and use of LCP for solving quadratic programming problems 6. Separable Programming. Linear fractional Programming, Geometric Programming, Stochastic Programming	**20%**
Module III : Dynamic Programming	
Descriptors/Topics 1. Introduction ,Dynamic Programming Terminology 2. Developing Optimal Decision Policy 3. Dynamic Programming Under Certainty, Dynamic Programming Approach for Solving Linear Programming Problems 4. Bellman's principle of optimality and recursive relationship of dynamic programming for various optimization problems	**20%**
Module IV : Goal Programming	
. **Descriptors/Topics** 1. Introduction,Difference between L.P and G.P approach, Concept of Goal Programming 2. Goal Programming model formulation 3. Graphical solution method for Goal Programming 4. Modified Simple method of Goal Programming **5.** Alternative Simplex Method for Goal Programming	**15%**
Module V : Replacement and Maintenance Models	
Descriptors/Topics 1. Introduction, Types of failure 2. Replacement of items whose efficiency deteriorates with time 3. Replacement of items that completely fail **4.** Mortality and staffing problems, Miscellaneous Replacement problems	**15%**

Module VI : Markov Chains	
Descriptors/Topics 1. Definition Introduction, Characteristics of a Markov Chain, Applications of Markov Analysis 2. State and Transition Probabilities, Multi period Transition Probabilities 3. Steady-state conditions 4. Absorbing States and Accounts Receivable Application	**10%**

Student Learning Outcomes:

After successfully completing the course, students should be able to do the following:
1.To provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate
2.To introduce some widely used advanced operations research models.
3.Identify and develop operational research models from the verbal description of the real system.
4.Understand the mathematical tools that are needed to solve optimisation problems.
5.Use mathematical software to solve the proposed models.
6.Analyse the results and propose recommendations
7.Understand the role of uncertainty in decision-making

Pedagogy for Course Delivery:

The course pedagogy will include lectures, numerical practice. and discussion on case studies .

Lab/ Practicals details, if applicable:

List of Experiments:

1. Write a C program to find out:
   i) The determinant of a matrix A and matrix B
   ii) Multiplication of matrix A and matrix B
2. Write a program to solve a given LPP.
3. Write a program to solve a given Non-linear programming problem.
4. Write a program to solve a given goal programming problem
5. Write a program to solve a given transportation problem.
6. Write a program to solve a given dynamic programming problem
7. Write a program to solve a given Assignment problem

8. Write a program to solve a given queuing problem
9. Write a program to solve a given sequencing problem.
10. Write a program to implement gaming theory
11. Write a program to solve a given networking problem

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**TOTAL**
66.67%	**33.33%**	**100%**

Theory Assessment (L&T):

	Continuous Assessment/Internal Assessment				**End Term Examination**
Components	**Class Test**	**Home Assignment**	**Quiz/ Viva**	**Attendance**	**EE** 70
Weightage (%)	10	07	08	05	

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				**End Term Examination**	
Components (Drop down	**A**	**PR**	**LR**	**V**	**PR**	**V**
Weightage (%)	5	10	10	5	35	35

Text & References:
Text Books:.

1. Non Linear Programming: Theory and Algorithms - M.S. Bazara and C.M. Shetty, John Wiley.
2. Non-linear Programming- W.I. Zangwill, Prentice Hall.
3. Operations Research: Theory and Applications- J K Sharma,Macmillan.

Reference Books:

1. Practical Methods of constrained optimization - R. Fletcher, John Wiley.
2. The Art and Theory of Dynamic Programming - S.E. Dreyfus, Academic Press.
3. Applied Dynamic Programming - R. Bellman and S. Dreyfus, Princeton, N.J.
4 Integer Programming - R.S. Garfinkel and G.L. Nemhauser, John Wiley.
5. Integer Programming: Theory, applications and Computations - H.M. Taha, Academic Press

Any other Study Material:

6. Lab Manual
7. Webpages