OPTIMIZATION TECHNIQUES					
Course Code	:	16G5B07		**CIE Marks**	:	100
Credits	:	L: T: P: S:4:0:0:0		**SEE Marks**	:	100
Hours	:	44		**SEE Duration**	:	3 Hrs

Course Learning Objectives:

1. To understand the concepts behind optimization techniques.
2. To explain the modeling frameworks for solving problems using optimization techniques.
3. To design and develop optimization models for real life situations.
4. To analyze solutions obtained using optimization methods.
5. To compare models developed using various techniques for optimization.

Unit – I	**09 Hrs**

Introduction: OR Methodology, Definition of OR, Application of OR to Engineering and Managerial problems, Features of OR models, Limitations of OR.

Linear Programming: Definition, Mathematical Formulation, Standard Form, Solution Space, Types of solution – Feasible, Basic Feasible, Degenerate, Solution through Graphical Method. Problems on Product Mix, Blending, Marketing, Finance, Agriculture and Personnel.

Simplex methods: Variants of Simplex Algorithm – Use of Artificial Variables.

Unit – II	**09 Hrs**

Duality and Sensitivity Analysis: Graphical sensitivity analysis, Algebraic sensitivity analysis - changes in RHS, Changes in objectives, Primal-Dual relationships, Economic interpretation of duality, Post optimal analysis - changes affecting feasibility and optimality, Revised simplex method

Unit – III	**08 Hrs**

Transportation Problem: Formulation of Transportation Model, Basic Feasible Solution using North-West corner, Least Cost, Vogel's Approximation Method, Optimality Methods, Unbalanced Transportation Problem, Degeneracy in Transportation Problems, Variants in Transportation Problems

Assignment Problem: Formulation of the Assignment problem, solution method of assignment problem-Hungarian Method, Variants in assignment problem, Travelling Salesman Problem (TSP).

Unit – IV	**09Hrs**

Queuing Theory: Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing models. Introduction to M/M/C and $M/E_k/1$ queuing models

Game Theory: Introduction, Two person Zero Sum game, Pure strategies, Games without saddle point - Arithmetic method, Graphical Method, The rules of dominance

Unit – V	09 Hrs
Markov chains: Definition, Absolute and n-step transition probabilities, Classification of the states, Steady state probabilities and mean return times of ergodic chains, First passage times, Absorbing states. Applications in weather prediction and inventory management. Over view of OR software's used in practice.	

Course Outcomes: After going through this course the student will be able to
CO1: Understand the various optimization models and their areas of application. CO2: Explain the process of formulating and solving problems using optimization methods. CO3: Develop models for real life problems using optimization techniques. CO4: Analyze solutions obtained through optimization techniques. CO5: Create designs for engineering systems using optimization approaches.

Reference Books:	
1.	Taha H A, Operation Research An Introduction, PHI, 8th Edition, 2009, ISBN: 0130488089.
2.	Philips, Ravindran and Solberg - Principles of Operations Research – Theory and Practice, John Wiley & Sons (Asia) Pte Ltd, 2nd Edition, 2000, ISBN 13: 978-81-265-1256-0
3.	Hiller, Liberman, Nag, Basu, Introduction to Operation Research, Tata McGraw Hill 9th Edition, 2012, ISBN 13: 978-0-07-133346-7
4.	J K Sharma, Operations Research Theory and Application, Pearson Education Pvt Ltd, 4th Edition, 2009, ISBN 13: 978-0-23-063885-3.
5.	Prof. J Govardhan, Principles, Methodology and Applications of Operations Research, JEM Consultants, 3rd Edition, 2012

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation method	Marks
Quiz -1	10
Test -1	50
Quiz-2	10
Test -2	50
Quiz-3	10
Test-3	50
Assignment	10
Final evaluation quiz 10+10+10=30 Test 50+50+50=150 Reduced to 60, Assignment 10	

		What	To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
ss	me	CIE	Quiz	Students	Three	30	Answer	80%	100%	90%

		Test		Two	60	Scripts			
		Assignment		2 phases	10	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment methods		Course End Survey	Students	End of course		Questionnaire Based on COs	10%		

Note: All the three tests and quizzes are compulsory

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2	2		1	1							
CO3							1	1				
CO4	2		3		1							
CO5			2			1						1

Low-1   Medium-2   High-3