Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA 33	Operations Research	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Basic knowledge of Mathematics and Statistics
Course Outcomes	CO1	Apply Operations research methodology to a broad range of problems in business and industry.
	CO2	Use mathematics and mathematical modelling using computers to forecast the implications of various choices.
	CO3	Solve optimization problems.
	CO4	Think of new methods for solving optimization problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Nature of Operation Research**	1,2	1
	1.1	History ,Nature of Operation Research ,Impact of Operation Research, Application Areas		
2		**Overview of Modeling Approach**	1,2	2
	2.1	Formulating the problem, Constructing a mathematical model, Deriving a solution, Testing a model and the solution		
	2.2	Establishing control over the solution, Implementation issues		
3		**Linear Programming**	3,4,5	13
	3.1	Introduction ,Graphical solution, Graphical sensitivity analysis		
	3.2	The standard form of linear programming problems, Basic feasible solutions,		
	3.3	Simplex algorithm, Artificial variables		
	3.4	Big M and two phase method		
	3.5	Solution to Problems based on Degeneracy, Alternative optima, Unbounded solution, Infeasible solutions		
4		**Dual Problem**	6,7	5
	4.1	Relation between primal and dual problems		
	4.2	Dual simplex method, Sensitivity analysis		
5		**Transportation Problem**	3,6,7	6
	5.1	Starting solutions. North-west corner Rule – least cost methods		
	5.2	Vogel's approximation method, MODI Method		
	5.3	Minimization and Maximization problem		
6		**Assignment Problem & Travelling Salesman Problem**	4,8,10	5

	5.1	Assignment Problem: Hungarian method (Minimization and Maximization)		
	5.2	Traveling Salesman Problem: Branch & Bound technique		
	5.3	Hungarian method		
7		**Sequencing Problem**	4,7,9	3
	5.1	Two machines n jobs		
	5.2	Three machines n jobs		
	5.3	N machines m jobs		
8		**Replacement Theory**	9,10	4
	5.1	Replacement of items that deteriorate		
	5.2	Replacement of items that fail group replacement and individual replacement		
8		**Game Theory**	9	3
	5.1	Two person Zero sum games		
	5.2	Solving simple games.		
			Total	**42**

References:

[1] Taha H. A., "Operation Research-An Introduction" , McMillan Publishing Company, NY
[2] Hillier F., and Lieberman G.J, Holden Day, "Introduction to Operation Research"
[3] P. K. Gupta & Hira, S. Chand, "Operations Research"
[4] Waynel L. Winston Thomson, "Operations Research Applications and Algorithms"
[5] Kambo, N.S., "Mathematical Programming Techniques", McGraw Hill
[6] Ravindran, "Operations Research- Principles and Practice", Wiley Production
[7] L E Prasad, "Operations Research",Cengage Learning
[8] K.V. Mital& Mohan New Age, "Optimization Methods"
[9] KantiSwaroop, Gupta P.K. Man Mohan, Sultan Chand and Sons, "Operations Research"
[10] S.D. Sharma, "Operation Research"
[11] H.M Wagher, "Principles of Operation Research (with applications to managerial decisions)" ,PHI, New Delhi