B.E Semester: 6 Mechanical Engineering
Subject Name: Operation Research (ME602-N)

A. Course Objective:

This course provides strong foundation for understanding the fundamental principles and laws of Operation Research to understand Linear programming, network Analysis and queuing, replacement models. Students can understand and solve the problems regarding management and application of various models.

B. Teaching / Examination Scheme:

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
4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus:

Topic No.	Details
1	**Introduction:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.
2	**Linear Programming (LP) :** Concepts, Formulation of model, Graphical solution, Maximisation / Minimisation – Simplex Algorithm, Use of slack / surplus / artificial variables, Big M and Two phase method – Nature & type of solutions, Interpretation of optimal solution. Dual problem – relation between primal and dual, Dual simplex method – Interpretation of dual variables, Introduction to Integer programming, Economic Interpretation.
3	**Transportation & Assignment problems:** Concepts, formulations of models, Solution procedures, Optimality checks, Balanced/Unbalanced, Maximum/Minimum problems, Prohibited case – degeneracy
4	**Replacement Models:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.
5	**Game Theory:** Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods.
6	**Decision Theory:** Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, hurwicz criterion, Decision tree.
7	**Queuing Models:** Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA
8	**Project Management:** Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.

Total hours (Theory):64
Total hours (Practical):32
Total hours:96

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd}	Unit 1	10%	1
2	$3^{rd}4^{th}$ .5^{th}	Unit 2	25%	2
3	7^{th} , 8^{th} ,9^{th}	Unit 3	25%	3,4
4	10^{th} ,11^{th}	Unit 4	10%	5
5	12^{th},13^{th} , 14^{th}	Unit 5	20%	6,7
6	$15^{th,}$,16^{th}	Unit 6	10%	8

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted toequivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overallinternal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for theconcept being taught in lectures. Suggested list of experiment is given below

F. List of Practical:

Assignments from different chapters to be given to students. Numerical to be solved from each chapter in tutorial class.

Design based Problems (DP)/Open Ended Problem:

1. Exercise on Game Theory
2. Study of Dynamic Programming problems.
3. Implementation of Simplex
4. Minimum spanning tree algorithm

G. Students Learning Outcomes:

- Identify and develop operational research models from the verbal description of the real system.
- Understand the mathematical tools that are needed to solve optimisation problems.
- Use mathematical software to solve the proposed models.
- Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

H. Text Books & Reference Books:

1	Quantitative Techniques in management, N.D. Vora – Tata McGraw Hill
2	Operations Research – An Introduction – Fifth edition by Hamdy A Taha- Prentice Hall of India ,

	New Delhi.
3	Principles of Operations Research : With Applications to Management Decisions, Wagner, H.M. , Prentice-Hall of India, New Delhi, 1982.
4	Hillier, F.S. and Lieberman, G.J., Operations Research, Holden Day Inc., San Francisco, 1974.
5	Littlechild, S.C. (ed), Operational Research for Managers, Philip Allan, Oxford, 1977.
6	Mitchell, G.H. (ed), Operational Research Techniques and examples, The English Universities Press Ltd., London, 1972. Moder, J.J. and Elmaghraby, S.E. (ed.), Handbook of Operations Research: Models and Applications, Van Nostrand Reinhold Co., New York, 1987.
7	Payne, T. A., Quantitative Techniques for Management: A Practical Approach, Reston Publishing Co.Inc., Virginia, 1982. Wilkes, F.M., Baum, P. and Smith, G.D., Management Science: An introduction, John Wiley and Sons, Santa Barbara, 1979.