Program : **Diploma in Mechanical Engineering / Tool and Die Engineering / Manufacturing Technology**	
Course Code : **6022B**	Course Title: **Operation Research**
Semester : **6**	Credits: **4**
Course Category: **Program Elective**	
Periods per week: **4 (L:3 T:1 P:0)**	Periods per semester: **60**

Course Objectives:

- To impart knowledge of main concepts and tools of operations research.
- To identify and solve the mathematical models of managerial problems in industry and to apply these techniques constructively to make effective business decisions.

Course Prerequisites:

Topic	Course code	Course name	Semester
Linear or matrix algebra, formulation and solution techniques,		Mathematics-I	1
Principles of Management, Functions of Management		Industrial management and safety	5

Course Outcomes:

On completion of the course, the students will be able to:

COn	Description	Duration (Hours)	Cognitive level
CO1	Develop the formulation and solving of linear programming models	15	Applying
CO2	Implement Transportation and Assignment models at workplace	14	Applying
CO3	Apply theoretical knowledge in sequencing and queueing theory to solve problems	15	Applying
CO4	Apply theoretical knowledge of game theory to solve games with or without saddle points	14	Applying
	Series Test	2	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2					
CO2	3	2					
CO3	3	2					
CO4	3	2					

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Develop the formulation and solving of linear programming models**		
M1.01	Recognize the importance, characteristics and applications of Operations Research.	4	Understanding
M1.02	Explain the concept of linear programming formulation	4	Applying
M1.03	Solve simple problems with different L P methods	7	Applying
Contents: **Operation research:** Definitions, Types of models; General solution methods for solving OR models, Characteristics of a good model, advantages, limitations, applications. Linear programming, introduction, formulation, concept of feasible and optimal solutions; graphical method, Simplex Method (Numerical problems). applications, advantages and limitations of LPP-Basic concepts of artificial variable technique, Duality principle.			
CO2	**Implement the Transportation and Assignment models at workplace.**		
M2.01	Explain the formulation of transportation Problems for finding Optimal solution	4	Applying
M2.02	Solve unbalanced transportation problems with different methods.	5	Applying
M2.03	Solve the problems related to assignment problems	5	Applying
	Series Test – I	1	
Contents: **Transportation Problems:** Definition of transport model, Formulation; Optimal solution; Unbalanced Transportation problems; North west corner method, least cost method, Vogel's approximation method. Assignment problem: Solution methods for initial feasible solutions-profit maximization and travelling salesman problems.			

CO3	**Apply theoretical knowledge in sequencing and queueing theory to solve problems**		
M3.01	Describe sequencing terminology, notations assumptions and basic rules in queuing theory	3	Understanding
M3.02	Explain the method of processing ‘n’ jobs through one machine and ‘n’ jobs through two machines.	3	Understanding
M3.03	Solve problems with ‘n’ jobs through one machine and ‘n’ jobs through two machines.	3	Applying
M3.04	Describe the applications of queuing theory and solve simple problems related to queue to find the average length, number of units, waiting time.	6	Applying
Contents: **Sequencing:** Introduction; Terminology; Notations and Assumptions; sequencing n-jobs on one machine, n-jobs on two machines – simple problems **Queuing models:** Optimal sequence algorithm queuing theory, characteristics, applications, notations, M/M/1-simple basic problems.			
CO4	**Apply theoretical knowledge of game theory to solve games with or without saddle points**		
M4.01	Describe the basic terminology of game theory	1	Understanding
M4.02	Demonstrate the Maximum–Minimax principle.	2	Understanding
M4.03	Solve problems for computing optimum strategy of the game, two - person - zero sum using max- min and min-max principle.	5	Applying
M4.04	Solve game theory problems without saddle points and matrix reduction by dominance.	6	Applying
	Series Test – II	1	
Contents: **Theory of games:** Introduction; definitions; assumptions, Two-person zero-sum games; The Maximin – Minimax principle. Games without saddle points; Mixed Strategies; 2 x n and m x 2 Games; Dominance property			

Text /Reference:

T/R	Book Title/Author
T1	Operations Research: Principles and Applications - G.Srinivasan, PHI Learning Private Limited.
T2	Operation Research:Premkumar Gupta and D.S Hira
T3	Operation Research: R.Paneerselvam
T4	Operation Research: A.P. Verma- S.K. Kataria& Sons
R1	Operations Research: An Introduction - Hamdy A. Taha, Pearson.
R2	Operations Research: Principles and Practice - Ravindran, Phillips and Solberg, Wiley India
R3	Operations Research: Concepts and Cases - Hillier and Liberman, McGraw-Hill

Online Resources:

Sl.No	Website Link
1	https://nptel.ac.in/courses/112/106/112106134/
2	https://nptel.ac.in/courses/110/106/110106062/
3	https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
4	https://ndl.iitkgp.ac.in/