Semester-2

Session: 2026-27

Part A – Introduction

Subject	Mathematics		
Semester	II		
Name of the Course	Linear Programming		
Course Code	MIC-II		
Course ID	260/MAT/MIC102		
Course Type: (CC/MIC/ MDC/ /VOC/AEC/VA C/SEC)	MIC		
Pre-requisite for the course (if any)	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes(CLOs)	After completing this course, the learner will be able to: 1. Formulate linear programming problems and identify their components. 2. Solve LPPs graphically and understand primal–dual relationships. 3. Apply the simplex method and analyze feasibility and optimality cases. 4. Solve LPPs using artificial variable methods and compare their approaches.		
Credits	**Theory**	**Practical**	**Total**
	1	1	2
Contact Hours	1	2	3
Internal Assessment Marks	5	5	10
End Term Assessment Marks	20	20	40
Examination Time	2 Hours		

Part B - Course Content

Instructions for Paper- Setter Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Learning Outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topic	Contact Hours
I	Introduction to Operations Research, its scope and methodology. Optimization problems, Linear Programming Problem (LPP): Definition, Requirements for a Linear Programming Problem, Advantages and limitations of Linear Programming, Formulation of Linear Programming Problems, Objective function, constraints and decision variables	**15**
II	Graphical solution: Multiple, unbounded and infeasible solutions. Duality in LPP, primal-dual relationship.	
III	Principle of simplex method: standard form, basic solution, basic feasible solution. Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, multiple solution and unbounded solution and degeneracy	
IV	Need for artificial variables, Two Phase method, Big-M method, Comparison of Two Phase and Big-M methods	

Practical

The following practicals will be done and their record will be maintained in the practical note book: **30**

1. Identification of optimization problems from real-life situations and classification into maximization and minimization problems.
2. Formulation of Linear Programming Problems by defining objective function, decision variables, and constraints from given statements.
3. Conversion of formulated LPPs into standard form suitable for graphical or simplex methods.
4. Graphical solution of two-variable LPPs and identification of feasible region and optimal solution.
5. Graphical analysis of multiple, unbounded, and infeasible solutions of LPPs.
6. Formulation of the dual problem for a given primal LPP and verification of primal–dual relationships.
7. Identification of basic solutions and basic feasible solutions for LPPs in standard form.
8. Solution of LPPs using the simplex method resulting in a unique optimal solution.
9. Solution of LPPs using the simplex method involving degeneracy and multiple optimal solutions.
10. Detection and illustration of unbounded and infeasible solutions using the simplex method.
11. Solution of LPPs requiring artificial variables using the Two Phase method.
12. Solution of LPPs using the Big-M method and comparison of results obtained using Two Phase and Big-M methods.

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory 5** • Class Participation /assignment/quiz/class test etc.: 5 ➢ **Practicum 5** • Seminar/Demonstration/Viva-voce/Lab records etc.: 15	**End Term Examination:** ➢ **Theory 20** • Written Examination ➢ **Practicum 20** • Lab record, viva-voce, write up and execution of the program

Part C-Learning Resources

Recommended Books:

1. J.K. Sharma, Mathematical Model in Operations Research, Tata McGraw Hill.
2. H.A. Taha, Operations Research – An Introduction.
3. Kanti Swarup, P.K. Gupta, and Manmohan, Operations Research.
4. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.
5. S.I. Gass, Linear Programming (3rd Edition), McGraw Hill, New York, 1985.
6. S.D. Sharma, Operations Research.
7. N.S. Kambo, Mathematical Programming.
8. G. Hadley, Linear Programming, Narosa Publishing House, 1987.