MSTE-002
Industrial Statistics-II

Indira Gandhi National Open University
School of Sciences

Block

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OPTIMISATION TECHNIQUES-I

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INDUSTRIAL STATISTICS-II

The elective MSTE-002 entitled **Industrial Statistics-II** is the second course for the specialisation in Industrial Statistics in the PG Diploma programme in Applied Statistics. This course has been designed to develop skills in applying the techniques and tools of statistics to industrial and business data. It deals with the concepts and techniques of Operations Research, Regression Modelling and Time Series Modelling. The purpose of this course is to provide you with a meaningful introduction to the concepts and applications of statistical techniques. Such statistical techniques and tools are sought in diverse fields including engineering, operations research, management science, computer science, systems analysis, business and economics. This course is designed to equip you with the ability to apply the techniques to both practical and theoretical problems. This knowledge will also enable you to study advanced techniques in this area. This course consists of four blocks.

In Blocks 1 and 2 of this course, you would be studying the concepts and techniques of Operations Research. In Block 1, we discuss the basics of Linear Programming Problem and the Simplex method of solving it. The Transportation Problem is also discussed in Block 1. In Block 2, we discuss various methods for solving the Assignment problems, Queueing problems, Sequential problems and Inventory problems.

In Block 3 of the course you shall study the concepts of Regression modelling. Regression analysis is a statistical tool for investigating and analysing the average relationship between two or more variables. Block 4 of this course describes the concepts of Time series analysis and forecasting techniques. The techniques discussed in Blocks 3 and 4 are useful in decision making and planning for future by governments, institutions, industries and even individuals.

BLOCK 1 OPTIMISATION TECHNIQUES-I

In many practical situations, we need to assist in solving strategic and tactical problems, i.e., to discuss, evolve and suggest ways and means to improve the execution of managerial and technological policy of any government, institution, industry or organisation. This new approach to systematic and scientific study of the operations of the system is called Operations Research.

Operations Research employs scientific methods for the purpose of solving problems and determining the best utilisation of limited resources. In this Block, we discuss these scientific methods, techniques and tools and their application to problems involving the operations of a system so as to provide those in control of the system with optimum solutions to the problem.

The Block is divided into four units.

Unit 1 entitled **Introduction to Operations Research** highlights the nature, scope, applications, uses and limitations of Operations Research. It also provides a broad classification of different O.R. models. We also discuss the concept of convex set and basic feasible solution of an LPP.

In Unit 2 entitled **Linear Programming Problems**, we discuss the linear programming problems and explain how these are formulated mathematically. The objective function is defined and graphical method of obtaining optimum value is also explained in this unit.

However, linear programming problems involving more than two decision variables cannot be solved by graphical method. Therefore, in Unit 3 entitled **Simplex Method**, we first discuss the trial and error method and then the Simplex method of solving the linear programming problems. We also explain the artificial variable technique and Big M method of solving the LPP.

Transportation problem is one of the special cases of LPP. Unit 4 entitled **Transportation Problem** describes different methods for obtaining the initial basic feasible solution and optimum solution of the transportation problem. In this unit, we explain various methods of solving the transportation problems with special cases such as the unbalanced transportation problem, degeneracy, alternative solutions, maximisation transportation problem and problems with prohibited routes.

Notations and Symbols

Z	:	Objective function to be maximised or minimised
X_i	:	i^{th} basic variable
C_i	:	Cost coefficient of i^{th} basic variable X_i
(a_{ij})	:	A m × n real matrix of m×n constants
$\{b_i\}$	:	A set of constants
A_i	:	i^{th} Artificial Variable
s_i	:	i^{th} slack/surplus variable
Max.	:	Maximise
LPP	:	Linear Programming Problem
$c_j - z_j$	:	Net evaluation
RR	:	Replacement Ratio
Qty	:	Quantity
$\boxed{a_{ij}}$	:	Key element/pivot element
M	:	An arbitrarily large number
D_j	:	j^{th} destination
C_{ij}	:	Cost of transporting one unit from origin i to destination j
O_i	:	i^{th} origin
a_i	:	Capacity/availability of items at origin i
b_j	:	Requirement/demand of the destination j
x_{ij}	:	Number of units transported from origin i to destination j
Sec.	:	Section/Subsection
Secs.	:	Sections/Subsections
Fig./Figs.	:	Figure/Figures