Teaching Plan (April-July 2022)
B.Sc. (Prog.) Mathematical Sciences (CBCS-LOCF)
DSE-2: Probability Theory and Statistics

Course Objectives: To provide a foundation in probability theory and statistics in order to solve applied problems and to prepare for providing the solutions that take account of their everyday experiences with their scientific interests.

Course Learning Outcomes: This course will enable the students to learn:

i) Basic probability axioms and familiar with discrete and continuous random variables.
ii) To measure the scale of association between two variables, and to establish a formulationhelping to predict one variable in terms of the other, i.e., correlation and linear regression.
iii) Central limit theorem, which helps to understand the remarkable fact that**:** the empirical

Month	Topic
January	**Unit 1 (3 Weeks)** Sample space, Probability set function, Real random variables - Discrete and continuous, cumulative distribution function, Probability mass/density functions, Mathematical expectation, Moments, Moment generating function, Characteristic function; Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson;
February	**Unit 1 (2 Week)** Continuous distributions**:**Uniform, Gamma, Exponential and Normal; Normal approximation to the binomial distribution **Unit 2 (2 Weeks)** Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, **Two graded Assignments will be given from Unit 1 and Unit 2, respectively, as a part of the Internal Assessment.**
March	**Unit 2 (2 Weeks)** Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations. **Unit 3 (3 Weeks)** Independent random variables, Covariance, Correlation coefficient; Linear regression for two variables and the method of least squares; Chebyshev's theorem. **The first test will be scheduled from Unit 1 as a part of the Internal Assessment.**

April	**Unit 3 (3 Weeks)** Statement and interpretation of (weak) law of large numbers and strong law of large numbers; Central limit theorem for independent and identically distributed random variables with finite variance. **The second test will be scheduled from Units 2 and 3 as a part of the Internal Assessment.**

Text Books:

1. Hogg, Robert V., McKean, Joseph W., & Craig, Allen T. (2013). Introduction to Mathematical Statistics (7th ed.), Pearson Education, Inc.

2. Miller, Irwin, & Miller, Marylees (2014). John E. Freund's: Mathematical Statistics with Applications (8th ed.). Pearson Education Ltd. Indian Reprint. Dorling Kindersley.

3. Ross, Sheldon M. (2014). Introduction to Probability Models (11th ed.). Elsevier Inc.

Additional Reading:

Mood, Alexander M., Graybill, Franklin A. & Boes, Duane C. (1974). Introduction to The Theory of Statistics (3rd ed.). McGraw-Hill Education, Indian Edition (2017).

Teaching Plan (April-July 2022)
B.Sc. (Prog.) Mathematical Sciences (CBCS-LOCF)
DCC 1B: Inventory and Marketing Management

Course Objectives: To acquaint students with the concept of Inventory, to understand the meaning of Inventory control as well as various forms and functional role of inventory. To impart the knowledge for determining the Optimal Order Quantity for Deterministic and Probabilistic models and to understand Production scheduling problems.
To understand the theory of marketing and its role in an organization. To discuss the uses and limitations of mathematical models in marketing and classification of marketing structure in competitive conditions.

Course Learning Outcomes: This course will enable the students to :

iv) Explain the meaning of Inventory control, various forms and functional role of Inventory.
v) Apply various Selective inventory control techniques to classify inventory items into broad categories.
vi) Understand different types of costs in inventory systems.
vii) Calculate the Economic Order Quantity(EOQ) for various Deterministic and Probabilistic Inventory models.
viii) Calculate EOQ when quantity discounts are available.

ix) Compute the Reorder Level(ROL) to determine time of replenishment with known and unknown patterns of demand for inventory items.

x) Understand Multi-item EOQ model with constraints,Inventory models with All Units Quantity Discounts,

xi) Appreciate Single period probabilistic inventory models with discrete and continuous demand.

xii) Demonstrate solution methods for Production Scheduling Problems.

xiii) Understand the role of marketing in an organization.

xiv) Differentiate between old and new concept of Marketing.

xv) Explain the different marketing decisions and scientific marketing analysis.

xvi) Derive joint optimization models of price, quality and promotional efforts.

xvii) Understand uses and limitations of mathematical models in marketing.

xviii) Classify market structure in Competitive conditions.

xix) Apply demand elasticity for joint optimization of price, quality and promotional efforts.

xx) Perform Brand switching analysis to find the equilibrium market share.

xxi) Formulate Media allocation problem for advertisement.

xxii) Apply the knowledge of various pricing strategies to grab maximum market share.

Month	Topic
April	**Unit 1 (3 Weeks)** Concepts and problems in Inventory Systems, Selective inventory classification and its use in controlling inventory, Different costs in Inventory Systems and method of their estimation.
May	**Unit 2 (3 Weeks)** Deterministic Inventory models with and without lead time and with and without shortages. Determination of reorder level (ROL) for all the models. **Unit 3 (1 Week)** Multi-item EOQ model with constraints, Inventory models with All Units Quantity Discounts **One graded Assignment will be given from Unit 1 and Unit 2, as a part of the Internal Assessment.**
June	**Unit 3 (2 Weeks)** Single period probabilistic inventory models with discrete and continuous demand, Production scheduling problems. **Unit 4 (2 Weeks)** Concept of marketing and its role in an organization. Marketing decisions, Scientific marketing analysis. Uses and limitations of mathematical models in marketing, Classification of market structure in competitive conditions. **The first test will be scheduled from Units 2 and 3 as a part of the Internal**

	Assessment.
July	**Unit 5 (4 Weeks)** Demand elasticity, Joint optimization of price, quality and promotional efforts. Pricing decisions, Media allocation for advertisement, Brand switching analysis. **The second test will be scheduled from Unit 4 as a part of the Internal Assessment.**

Text Books:

i) Taha, H. A. (2007). Operations research-an introduction (8th ed.). New Delhi: Pearson Prentice Hall (Indian print).
ii) Waters D.(2010) Inventory Control, John Wiley.

Additional Reading:

Hillier, F.S., & Lieberman, G. J. (2010).
Introduction to operations research- concepts and cases (9th Ed.). New Delhi: Tata McGraw Hill (Indian print).
Hadley G.,&Whitin T.M.(1979).Analysis of Inventory-Systems,D.B.Taraporevala and Sons,Published by arrangement of Prentice Hall Inc.
Buffa,Elwood S.&Sarin Rakesh K.(2009).Modern Production/Operations Management(8th Ed.)Wiley India.
Zipkin(2000),Foundations of Inventory Management, McGraw Hall Inc.
Kotler P.(2008),Marketing Management(13th Ed.),Prentice Hall of India.
Graham J. Hooley and Michael K. Hassey(1999).Quantitative Methods in Marketing(2nd Ed.)International Thomson Business Press.

Teaching Plan (April-July 2022)
B.Sc. (Prog.) Mathematical Sciences (CBCS-LOCF)
DCC 1A: Introduction to Operational Research and Linear Programming

Course Objectives: To create awareness about the term Operational Research and acquaint them with the methodologies, scope, limitations and applications of Operational Research and to expose the students with the knowledge of formulation of real life problems using the linear programming method , to understand the theoretical basis of computational algorithms used in solving linear programming and related problems.

Course Learning Outcomes: This course will enable the students to :

xxiii) Understand the need of using operational research as a quantitative approach for effective decision making.

xxiv) Be familiar with various definitions of operational research, its historical perspective, characteristics and different phases of scientific study.
xxv) Describe the basic concepts of convex sets and basis.
xxvi) Identify situations where Linear Programming Problem can be applied and appreciate the assumptions of linear programming method with a view to interpret the solution.
xxvii) Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method, demonstrate the solution process by hand and solver
xxviii) Appreciate the significance of duality and explain the relationship between a linear program and its dual, including strong duality and complementary slackness.
xxix) Perform sensitivity analysis to identify the direction and magnitude of change of a linear programming model's optimal solution as the input data change

Month	Topic
November	**Unit 1 (1 Week)** Origin and Development of OR , Different phases of OR study, Methodology of OR
December	**Unit 1 (1 Week)** Scope and Limitations of OR, OR in decision making, Applications of OR. **Unit 2 (3 Weeks)** : Linear independence/ dependence of vectors, Basis of a vector space, Convex set and its properties, Extreme points. General Linear Programming Problem(LPP),Standard and Canonical form of LPP, Problem formulation, Graphical solution ,Theory of simplex method, **Two graded Assignments will be given from Unit 1 and Unit 2, respectively, as a part of the Internal Assessment.**
January	**Unit 2 (4 Weeks)** Simplex algorithm, Artificial variable techniques –Two phase method; Charne's M method ,Special cases in LPP, Finding inverse of a matrix using Simplex method, Solving system of Linear equations using Simplex method. **The first test will be scheduled from Unit 1 as a part of the Internal Assessment.**
February	**Unit 3 (4 Weeks)** Duality theory-Definition of the dual problem, Primal-dual relationships,, Fundamental theorem of Duality, Complementary slackness theorem, Economic interpretation of Duality Dual-simplex method. **The second test will be scheduled from Units 2 and 3 as a part of the Internal Assessment.**
March	**Unit 4 (2 Weeks)** Sensitivity analysis: Shadow price, Graphical and simplex method based

	approach for changes in cost and resource vector.

Text Books:

iii) Taha, H. A. (2007). *Operations research-an introduction* (8th ed.). New Delhi: Pearson Prentice Hall (Indian print).

iv) Bazara, M. S., Jarvis, J. J., & Sherali, H. D. (2004). *Linear programming and network flows* (3rd ed.). Wiley.

Additional Reading:

Gass, S. I. (1985). *Linear programming- methods and applications* (5th ed.). New York: McGraw Hill (Dover edition 2003 is also available).

Hadley, G. (2002). *Linear programming*. New Delhi: Narosa Publishing House.

Hillier, F.S., & Lieberman, G. J. (2010). *Introduction to operations research- concepts and cases* (9th ed.). New Delhi: Tata McGraw Hill (Indian print).

Ravindran, A., Phillips, D. T., & Solberg, J. J. (2005). *Operations research- principles and practice* (2nd ed.). New Delhi: Wiley India (P.) Ltd. (Indian print).

Thie, P. R., & Keough, G. E. (2008). *An introduction to linear programming and game Theory* (3rd ed.). New Jersey: John Wiley & Sons.

Wayne, Winston, L., & Venkataramanan, M. (2002). *Introduction to mathematical Programming (volume 1): applications and algorithms* (4th ed.). CA: Brooks-Cole Publishing.