Semester: VIII	
Course Title: Quantitative Techniques in Business	
Course Code: C4BC230831T	**Credits: 5**
Category: Major (Core) - Major (Core)	
Theory/Practical/Composite : Theory	

Course Overview:

This course introduces key quantitative methods used in business decision-making. It covers a range of models including Linear Programming, Transportation and Assignment Problems, Decision Theory, Game Theory, Queuing Models, Markov Chains, Inventory Management, and Network Analysis.

Students will learn to formulate, solve, and analyse real-world business problems using tools like the Simplex Method, Hungarian Method, Simulation, and PERT/CPM. Emphasis is placed on applying these techniques to areas such as resource allocation, logistics, production planning, and operations.

By the end of the course, learners will be able to apply quantitative tools effectively, evaluate decision alternatives, and design models to support strategic business goals.

Course Outcome:

CO1: Identify and recall the fundamental concepts, terminology, and types of Quantitative Techniques, including their applications and limitations in business decision-making.

CO2: Describe and explain the structure, assumptions, and working mechanisms of models like Linear Programming, Transportation, and Assignment Problems.

CO3: Solve and implement optimization models such as Simplex, Big-M, Hungarian, and Vogel's Approximation to support operational decisions.

CO4: Analyse and differentiate between various decision-making models under risk and uncertainty, including Game Theory strategies and simulation techniques.

CO5: Evaluate and justify solutions derived from queuing models, Markov chains, and inventory systems by applying relevant performance measures and criteria.

CO6: Formulate and design integrated quantitative models using tools like Critical Path Method (CPM), PERT, and Simulation to solve complex business problems and improve decision-making.

Prerequisites:

Basic Mathematics and Statistics: Students should have a working knowledge of algebra, linear equations, basic calculus (optional), and fundamental statistics, including measures of central tendency, probability, and data interpretation.

Introduction to Business or Management Concepts: Familiarity with basic business functions (operations, finance, supply chain, etc.) will help students connect quantitative models with real-world business applications.

SYLLABUS

Unit/Module with topic name	Content	Number of Classes	CO Mapping	Cognitive Level
I. Introduction to Quantitative Techniques and Linear Programming Problem (LPP)	• Meaning, Scope, and Importance of QT in Business • Types of Quantitative Techniques: Descriptive & Inferential	10	CO1, CO2, CO3, CO6	K1 (Remember), K2 (Understand), K3 (Apply), K6 (Create)

		• Applications in decision-making • Limitations of Quantitative Techniques • Introduction to LPP and formulation of linear programming models • Graphical method (two-variable problems) • Simplex method (basic problems) • Big-M method • Primal-Dual conversion • Applications in business (e.g., product mix, resource allocation) • Assumptions and limitations			
II.	Transportation Problems	• Transportation problems: North-West Corner, Least Cost, and Vogel's Approximation Method • Optimization using Modified Distribution method. • Degeneracy, Maximisation problem, Unreachable roots, Unbalanced Transportation problem	8	CO2, CO3	K2 (Understand), K3 (Apply)
III.	Assignment Problems	• Assignment problems: Hungarian method • Unbalanced problems and maximization cases	5	CO2, CO3	K2 (Understand), K3 (Apply)
IV.	Decision Theory and Game Theory	• Decision-making under uncertainty and risk • Payoff tables and decision criteria: Maximin, Maximax, EMV, Laplace and Hurwitz criteria • Game Theory: Two-person zero-sum games • Saddle point, Dominance Rule, and Graphical Method (2xN or Mx2, where M, N ≤ 4) • Concept of simulation and real-life application	12	CO1, CO4, CO5, CO6	K1 (Remember), K4 (Analyze), K5 (Evaluate), K6 (Create)

V.	Queuing Theory, Markov Chain and Inventory Models	• Basics of queuing models: single-channel (M/M/1) • Average queue length, waiting time • Introduction to Markov Chain, classification of state and transition matrix • Statement and application of Chapman-Kolmogorov equation. • Introduction to Inventory Control • EOQ Model, Reorder Point, Safety Stock	10	CO1, CO4, CO5	K1 (Remember), K4 (Analyze), K5 (Evaluate)
VI.	Network Analysis	• Network diagram • Time estimate for activity • Programme evaluation and review technique • Critical path method	7	CO6	K6 (Create)

Text Books

1. "Operations Research", by P. K. Gupta & D. S. Hira.
2. "Quantitative Techniques for Managerial Decisions", Vol. 1, 16e, by L. C. Jhamb.
3. "Quantitative Techniques for Management", by N. D. Vohra and Hitesh Arora.
4. "Introduction to Operations Research", by Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, and Preetam Basu.

Suggested readings

1. "Operations Research: Theory and Applications", by J.K. Sharma.
2. "Operations Research: An Introduction", by Hamdy A. Taha.
3. "Quantitative Techniques for Decision Making", by M.P. Gupta & R.B. Khanna.
4. "Operations Research", by S. Kalavathy.

Web Resources

1. https://nptel.ac.in/courses/110106062
2. https://onlinecourses.nptel.ac.in/noc24_ma28/preview
3. https://onlinecourses.swayam2.ac.in/cec20_mg18/preview
4. https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels

CO1	**Identify** and **recall** the fundamental concepts, terminology, and types of Quantitative Techniques, including their applications and limitations in business decision-making. *Mapped Units: Unit 1 (QT basics, types), Unit 4 (decision theory basics), Unit 5 (queuing theory, Markov chains).*	K1 (Remember)
CO2	**Describe** and **explain** the structure, assumptions, and working mechanisms of models like Linear Programming, Transportation, and Assignment Problems. *Mapped Units: Unit 1 (LPP), Unit 2 (Transportation), Unit 3 (Assignment).*	K2 (Understand)
CO3	**Solve** and **implement** optimization models such as Simplex, Big-M, *Mapped Units: Unit 1 (Simplex, Big-M), Unit 2 (Transportation methods), Unit 3 (Hungarian method).*	K3 (Apply)
CO4	**Analyse** and **differentiate** between various decision-making models under risk and uncertainty, including Game Theory strategies and simulation techniques. *Mapped Units: Unit 4 (Game Theory, simulation), Unit 5 (inventory models).*	K4 (Analyze)
CO5	**Evaluate** and **justify** solutions derived from queuing models, Markov chains, and inventory systems by applying relevant performance measures and criteria. *Mapped Units: Unit 5 (queuing, Markov, EOQ), Unit 4 (decision evaluation).*	K5 (Evaluate)
CO6	**Formulate** and **design** integrated quantitative models using tools like Critical Path Method (CPM), PERT, and Simulation to solve complex business problems and improve decision-making. *Mapped Units: Unit 6 (Network Analysis), Unit 4 (Simulation), Unit 1 (applications of QT).*	K6 (Create)