QUANTITATIVE METHODS AND ANALYTICS

23MBPC526

(COURSE HANDBOOK)

MBA

COURSE HEAD:

Asst. Prof. Akshitha

1. GENERAL INFORMATION

Welcome to Quantitative Methods and Analytics!

This course enhances students' understanding of analytical methods and their applications in business decision-making. The course combines foundational concepts of Operations Research (OR), data analytics, and statistical methods to provide students with a comprehensive tool-kit for tackling complex business problems.

The curriculum covers key topics such as Linear Programming Problems (LPP) for optimizing resource allocation, decision trees, job sequencing, and critical path analysis for project management. Advanced concepts like transportation problems, game theory, and assignment models are also explored. These modules aim to develop the ability to analyze real-world challenges and devise optimal solutions using quantitative approaches.

A unique aspect of the course is the inclusion of R programming, which equips students with the skills to handle data analysis and visualization tasks effectively. This hands-on approach ensures that learners are prepared to apply theoretical concepts to practical scenarios, leveraging modern tools to derive actionable insights.

By the end of the course, students are expected to summarize key principles of OR, apply statistical tools for data-driven decisions, and analyze business scenarios to propose effective solutions. With a blend of traditional and modern analytics techniques, this course provides a strong foundation for aspiring professionals in analytics and decision science. We look forward to an engaging and productive semester together!

1.1 Course Objectives

- **Analytics Familiarization**: Familiarize the students with concept of data Analytics for Business
- **Statistical Decisions**: Impart the knowledge on concepts of statistics in decision making.
- **Data Management**: Provide knowledge on concepts of Analytics in data-based management.

1.2 Course outcome

- CO1: Summarize the fundamental concepts of Operations Research.
- CO2: Apply statistical tools for advanced data analysis for insightful data-driven decision-making.
- CO3: Analyze complex business problems utilizing advanced statistical methods for optimal solutions.
- CO4: Apply the theoretical concepts to manage multi-machine and multi- task environments.
- CO5: Analyze data and solve complex decision-making problems in business.

1.3 **Set Text and Suggested Sources**

All the below mentioned books are available in the 1st Floor Library.

Key Text Books:

1. Anil Maheshwari, "Data Analytics", 2017, McGaw Hill Education.
2. Camm, Cochran et al, "Essentials of Business Analytics", 2021, Cengage Publication
3. J.K. Sharma, "Operation research", 2014, McMillan Publication

Reference Books:

1. Albright and Winston, "Business Analytics – Data Analysis decision making", Cengage Publication, 2022
2. James R Evan, "Business Analytics – Methods models and decisions", 3rd Edition, Pearson Publication, 2022
3. U. Dinesh Kumar, Business Analytics – The science of data driven decision making, 2nd Edition, Wiley Publication, 2022
4. H.S. Kasana & K.D Kumar, "Introductory Operations Research" -Theory and Applications, Springer Publication.
5. B. Uma Maheswari, R. Sujatha, "Introduction to Data Science: Practical Approach with R and Python, Wiley Publication 2021

2. THE COURSE

2.1 Course Description

QUANTITATIVE METHODS AND ANALYTICS			
Semester	**II**	CIE Marks	**50**
Course Code	**23MBPC526**	SEE Marks	**50**
Teaching Hrs/Week (L:T:P)	**4:0:0**	Exam Hrs	**03**
Total Hrs	**52**	Credits	**04**

The Quantitative Methods and Analytics course designed to provide students with foundational knowledge in operations research and data analytics. The course will run for 13 weeks during Semester II and consists of 5 modules that cover essential topics in quantitative and an application to business/ management related problems. Each week includes 4 lectures, delivered by Ms. Akshitha, focusing on theoretical concepts, practical applications, and course-related activities. Spanning a total of 52 hours, this 4-credit course is assessed through Continuous Internal Evaluation (CIE) for 50 marks and a Semester-End Examination (SEE) for 50 marks, with 3-hour exam duration. This structure ensures a balanced and engaging learning experience for students.

2.2 Initiating Contact with Staff and Other Students

We encourage open communication and value your inquiries about the Course. However, given the large number of students in this course, we encourage that you use email and any other forms of correspondence thoughtfully. Before reaching out with course questions, please check if your query has already been addressed in previous communications or in the materials provided in this handbook and on our website. Additionally, we encourage you to engage with your peers for discussions and collaborative learning, as this will enhance your understanding of the course material and foster a supportive academic community.

2.3 Resources

Resources go beyond just books—they include dynamic tools like digital libraries, e-learning platforms, and research databases. These modern learning environments offer anytime, anywhere access to academic materials, interactive courses, and cutting-edge research, empowering students to explore knowledge and excel in their fields.

Students can access a variety of resources through the college website. These include the VTU Consortium, e-learning platforms, and additional sources like open-access repositories, government portals (e.g., NPTEL, NDLI), These digital tools provide access to e-books, research papers, video lectures, and interactive tutorials, offering flexible and comprehensive learning environments.

E-learning and digital library can be accessed via the college website https://mite.ac.in/
(Campus Life section > Library > VTU Consortium/e-learning platforms/additional sources).

2.4 Staff

Course Convenor: Prof. Akshitha
Cabin: 2nd floor, PG Block
Email: akshitha@mite.ac.in

2.5 Topics and Reading materials for each module

Module 1 *No. of Hours: 9*

- **Topic: Introduction to Quantitative Methods**
  - Evolution of OR, Application of OR, Phases in OR, Models of OR
  - Linear programming: Linear Programming Problem (LPP), Generalized LPP - Formulation of LPP, Guidelines for formulation of the linear programming model, Assumption, Linear Programming problem (LPP), optimal and feasible Solutions by graphical method (minimization and maximization).
- **Activities:**
  - Providing students with a practical scenario, such as optimizing resource allocation in a small business. Ask them to formulate a Linear Programming Problem (LPP), identify the constraints and objectives, and solve it using graphical methods for both minimization and maximization cases.

- **Essential Readings:**
  - J.K. Sharma, "Operation research", 2014, McMillan Publication. Chapter 1 and 3

- **Additional Reading:**
  - H.S. Kasana & K.D Kumar, "Introductory Operations Research" -Theory and Applications, Springer Publications- Chapter 2

Module 2 *No. of Hours: 10*

- **Topic: Decision Tree**
  - Job Sequencing- 'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines.
  - Critical path method to find the expected completion time of a project, determination of floats in networks PERT networks, determining the probability of completing a project, predicting the project's completion time; and Cost analysis in networks.

  Activities:
  - Network Diagram Construction: Provide students with project data, including tasks, durations, and dependencies. Ask them to create a network diagram (Critical Path Method or CPM) to identify the critical path and calculate the expected project completion time. Students will gain hands-on experience with network modeling and critical path analysis.
- **Essential Reading:**
  - J.K. Sharma, "Operation research", 2014, McMillan Publication. Chapter 11 & 13

- **Additional Reading:**
  - H.S. Kasana & K.D Kumar, "Introductory Operations Research" -Theory and Applications, Springer Publications – Chapter 8 & 9

Module 3 *No. of Hours: 10*

- **Topic: Transportation Problem**
  - Formulation of transportation problem, types, initial basic feasible solution using North-West Corner Rule (NWCR), Least Cost Method (LCM) and Vogel's Approximation method (VAM).
  - Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization, T.P. Degeneracy in transportation problems, application of transportation problem.
- **Activities:**
  - Provide a real-world case study of logistics optimization in industries like e-commerce or supply chain management. Students must analyze the scenario, model it as a transportation problem, and propose an optimal solution. Students will relate theoretical concepts to industry applications.

- **Essential Reading:**
  - J.K. Sharma, "Operation research", 2014, McMillan Publication. Chapter 9 & Chapter 10

- **Additional Reading:**
  - H.S. Kasana & K.D Kumar, "Introductory Operations Research" -Theory and Applications, Springer Publications – Chapter 7

Module 4 *No. of Hours: 12*

- **Topic: Theory of Games**
  - Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems (Graphical and algebraic methods).
  - Problems on Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems. Travelling Salesman Problem (TSP). Difference between assignment and T.S.P.
- **Essential Reading**:
  - J.K. Sharma, "Operation research", 2014, McMillan Publication. Chapter 12

- **Additional Reading:**
  - J K Sharma (2020), Business Statistics 5 ed, Vikas Publishing House – Chapter 17

Module 5 *No. of Hours:11*

- **Topic: R Programming**
  - Introduction to R and R Studio, Basic object types and operations in R, Data Structure, Data import and export, Data manipulation and visualization (Simple graphs and trends), Arithmetic operations and loop, Simple statistical functions.
- **Essential Reading:**
  - B. Uma Maheswari, R. Sujatha, "Introduction to Data Science: Practical Approach with R and Python, Wiley Publication 2021- Chapter 2

- **Additional Reading:**
  - U. Dinesh Kumar, Business Analytics – The science of data driven decision making, 2nd Edition, Wiley Publication, 2022- Chapter 1

3 ASSESSMENT

The assessment for the Quantitative Methods and Analytics module is divided into two components: Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each accounting for 50% of the total marks.

Continuous Internal Evaluation (CIE) comprises two internal tests, scheduled for 8th and 14th week, which together contribute 30% of the total marks. Additionally, students can earn 20% through the completion of assignments (10 marks are allotted for Linear Programming, 10 marks are allotted for a Network Diagram Construction and Critical Path Analysis).

Semester End Examination (SEE) constitutes the remaining 50% of the total marks. Key information regarding examination dates and related details can be accessed via the college website (Academics and Courses section > Calendar of Events > PG Even Sem).

Rubrics for Other Assessment (Total: 20 Marks / 40% of CIE)

1. Linear Programming (10 Marks)				
Criteria	**10-8 Marks**	**7-6 Marks**	**5-3 Marks**	**3-1 Mark**
Problem Formulation	Clearly defines decision variables, constructs the objective function.	Defines most variables, objective function.	Defines some variable objective function.	Many errors in formulation, missing key constraints or variables.
Identification of Constraints	Lists and justifies all constraints with proper reasoning.	Justifies most constraints with minor errors.	Identifies constraints but lacks proper justification.	Many errors in listing or explaining constraints.
Graphical Representation	Correctly plots all constraints and the feasible region.	Plots most constraints and feasible region correctly, with minor mistakes.	Some constraints are plotted incorrectly or missing.	Feasible region is unclear or incorrect.
Solution Accuracy	Correctly identifies the optimal solution and validates it with the graphical method.	Identifies the optimal solution with minor validation errors.	Identifies a solution but with noticeable errors.	Major mistakes in identifying the solution.

2. Network Diagram Construction and Critical Path Analysis (10 Marks)				
Criteria	**10-8 Marks**	**7-6 Marks**	**5-3 Marks**	**3-1 Mark**
Network Diagram Construction	Accurately constructs the network diagram with all tasks and dependencies correctly represented.	Mostly accurate, with minor errors in dependencies or task representation.	Diagram includes most tasks and dependencies but has notable errors.	Significant errors in task dependencies or representation.
Identification of Dependencies	Clearly identifies and lists all task dependencies, ensuring accuracy in sequencing.	Identifies most dependencies correctly with minor mistakes.	Some dependencies are missing or incorrectly listed.	Many dependencies are incorrect or missing.
Critical Path Identification	Correctly determines the critical path and explains the reasoning or calculations behind it.	Determines the critical path with minor explanation errors.	Identifies a critical path but with notable errors.	Major mistakes in critical path identification.
Calculation of Project Duration	Accurately calculates the expected project completion time using the critical path.	Calculates project duration with minor errors.	Provides a duration estimate with notable mistakes.	Major errors in project duration calculation.