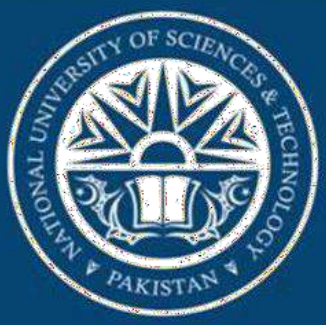

Data Analysis for Decision Making (OTM-830)

National University of Sciences & Technology (NUST)

Course Details:

Course Title: Data Analysis for Decision Making

Credit Hours: 3

Course Code: OTM-830

Pre-requisite: N/A

Program: EMBA

Sections: N/A

Course Description :

This course will enable students to use various quantitative methods that use numerical data, models, and algorithms to make decisions. The course is mainly divided into two modules. In the first module of this course, students will be introduced to the basics of mathematical modeling, including how to represent real-world problems as mathematical models and how to solve these models using a variety of software tools. These methods can be used to solve a number of problems, including resource allocation, inventory management, production schedule, pricing, transportation, supply chain etc. The second module will cover basics of data analytics through data cleaning, processing, analysis, and visualization through a selected data analytics software tool. We will cover the basics of data cleaning and processing, including how to identify and remove errors from data, how to transform data into a format that is suitable for analysis, and how to deal with missing data. In data analysis, we will cover a variety of techniques that can be used to analyze data, including descriptive statistics, regression analysis, clustering, and classification. Finally in the data visualization part, students will be introduced to the principles of data visualization and how to use visualization techniques to communicate the results of data analysis.

Course Learning Outcomes:

Upon completion of this course, the student should be able to:

1. CLO 1: *Develop* quantitative models to represent different business problems.
2. CLO 2: *Solve* business problems by using appropriate quantitative tools and techniques.
3. CLO 3: *Analyze* results and extract useful insights from the solutions of the given decision problems.
4. CLO 4: *Defend* analysis in oral form to effectively communicate solutions.
5. CLO 5: *Apply* quantitative tools in real life scenarios and present solutions in written form.

Program Goals & Learning Objectives:

General Learning Goals & Objectives of **EMBA program** are:

Goal 1: Students will be capable of critical thinking.

LO 1.1: Students will be able to solve problems with the application of business knowledge.

LO 1.2: Students will be able to evaluate competing decision criteria and alternatives.

Goal 2: Students will demonstrate leadership skills.

LO 2.1: Students will be able to develop the ability to lead and manage in teams.

LO 2.2: Students will be able to make sound decisions.

Goal 3: Students will learn to communicate effectively.

LO 3.1: Students will be able to communicate effectively in oral presentations.

LO 3.2: Student will be able to create professional reports.

Goal 4: Students will deal with the ethical dilemmas that arise in a business environment.

LO 4.1: Students will be able to identify ethical concerns emanating from a business situation.

LO 4.2: Students will be able to apply ethical guidelines to address business problems by examining a set of alternatives.

Mapping - CLOs with LOs

Learning Objective	LO 1.1	LO 1.2	LO 2.1	LO 2.2	LO 3.1	LO 3.2	LO 4.1	LO 4.2	Not mapped	Evaluation Item
CLO 1	●									Final Exam
CLO 2		✓								Case Study
CLO 3				✓						Case Study
CLO 4					●					Project
CLO 5						●				Project

Legends indicate:

✓ mapped and assessed CLO ● mapped but not assessed CLO × unmapped CLO

Required Course Material:

Textbook (s):

1. Bernard W. Taylor III, **Introduction to Management Science**, 12th Global Edition, Pearson

2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jefferey W. Ohlman, **Quantitative Methods for Business,** 12th Edition, CENGAGE Learning

Reference Book (s):

1. David R. Anderson, Dennis J. Sweeney Thomas A. Williams Rochester Jeffrey D. Camm Kipp Martin, "**An Introduction to Management Science: Quantitative Approaches to Decision Making"**, 13th Edition CENGAGE Learning
2. Barry Render, Ralph M. Stair, Jr., Trevor Hale, **Quantitative Analysis for Management,** 12th Global Edition, Pearson

Additional Material:

- Selected case studies from Harvard Business Publishing and research articles.

Software

Following software will be used for solving complex modelling and simulation problems during course and projects

1. Microsoft Excel -Solver

Course Evaluation:

Grading will be done as per NBS criteria. The breakup is as follows:

Final Exam	25%
Mid Term Exam	10%
In Class Experiential Activity	30%
Quizzes	10%
Assignments	10%
Group Project	15%

Weekly Schedule:

Week	Lecture No. and Topic	Preparation Material	Session Outcomes (Students should be able to…)
1	Lecture 1: ▪ Introduction to course policies ▪ Course outlines & assessments Lecture 2: Decision Analysis ▪ Components of decision making ▪ Decision making under certainty ▪ Payoff tables ▪ Different decision criteria	Bernard W. Taylor, **Introduction to Management Science**, Chapter 11 and 12.	*Develop* quantitative models torepresent different business problems (CLO 1).
2	Lecture 3 and 4: Decision making under uncertainty ▪ Expected Value (EV) ▪ Expected Opportunity Loss (EOL) ▪ Expected Value of Perfect Information (EVPI) ▪ Decision trees ▪ Decision trees with Excel and TreePlan ▪ Sequential decision trees ▪ Sequential decision tree analysis with Excel and TreePlan	Bernard W. Taylor, **Introduction to Management Science**, Chapter 11 and 12.	*Develop* quantitative models torepresent different business problems (CLO 1).
3	Lecture 5 & 6: ▪ Bayesian analysis ▪ Decision analysis with additional information ▪ Decision tree with posterior probabilities ▪ Computing Posterior Probabilities with Tables ▪ Expected Value of Sample Information (EVSI)	Bernard W. Taylor, **Introduction to Management Science**, Chapter 11 and 12.	*Solve* business problems by using appropriate quantitative tools and techniques (CLO 2).
4	Lecture 7 & 8: **HBP Case Study:** Decision Making and Decision Analysis	**Read the Case Study before coming to the class for discussion and/or written assessment**	*Analyze* results and extract useful insights from the solutionsof the given decision problems (CLO 3).
5	Lecture 9 & 10: Utility and Game Theory ▪ The Meaning of Utility ▪ Utility and Decision Making ▪ Risk Avoiders Versus Risk Taker ▪ Introduction to Game Theory ▪ Mixed Strategy Games	Anderson et. al,**Quantitative Methods for Business,** Chapter 5	*Analyze* results and extract useful insights from the solutionsof the given decision problems (CLO 3).
6	Lecture 11: **HBP Case:** Game Theory-Application in business world	**Read the Case Study before coming to the class for discussion and/or written assessment**	*Solve* business problems by using appropriate quantitative tools and techniques (CLO 2).

Week	Lecture No. and Topic	Preparation Material	Session Outcomes (Students should be able to…)
6	Lecture 12 Linear Programming ▪ Introduction ▪ Basic Mathematical Modelling ▪ Maximization and Minimization problem	Bernard. Taylor**, Introduction to Management Science,** Chapter 2 and 3	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).
7	Lecture 13 & 14 Graphical Solution of Linear Programming ▪ Plotting the constraint ▪ Feasible solution area ▪ The optimal solution points ▪ Slack variables	Bernard. Taylor**, Introduction to Management Science,** Chapter 2	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).
8	Lecture 15 & 16 Linear Programming- Excel Solution ▪ Basic Mathematical Modelling ▪ Linear Problem Examples ▪ Product Mix Example ▪ An Investment Example ▪ A Diet Example ▪ A Marketing Example	Bernard. Taylor**, Introduction to Management Science,** Chapter 3 and 4 Class will be held in Lab	*Solve* business problems by using appropriate quantitative tools and techniques (CLO 2).
9	**MID-TERM EXAM WEEK**		
10	Lecture 17 & 18 Integer Programming (IP) ▪ Problem Formulation ▪ Integer Programming Types ▪ Total Integer Programming ▪ Problem Formulation and solution ▪ Binary integers programming ▪ Problem Formulation and solution ▪ Solution with Excel	Bernard. Taylor**, Introduction to Management Science,** Chapter 3 and 4 Class will be held in Lab	*Solve* business problems by using appropriate quantitativetools and techniques (CLO 2)
11	Lecture 19 ▪ Capital Budgeting Problem, Fixed charge problem ▪ Mixed Integer Programming Problem Formulation and solution	Bernard. Taylor**, Introduction to Management Science,** Chapter 5 Class will be held in Lab	*Develop* quantitative models torepresent different business problems (CLO 1).
	Lecture 20 Case Study HBP- Optimal Investment Decision Integer Programming	**Read the Case Study before coming to the class for discussion and/or written assessment**	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).

Week	Lecture No. and Topic	Preparation Material	Session Outcomes (Students should be able to…)
12	Lecture 21 ▪ Transportation Models ▪ Transshipment ▪ Assignment problem	Bernard. Taylor**, Introduction to Management Science,** Chapter 6 Class will be held in Lab	*Develop* quantitative models torepresent different business problems (CLO 1).
	Lecture 22 Transportation Model: HBP Case Study	**HBSP Case:** DHL Global Forwarding Consolidation Program Class will be held in Lab	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).
13	Lecture 23 & 24 Multi-Criterion Decision Making ▪ The Analytical Hierarchy Process ▪ Excel Solution ▪ Scoring Models	Bernard. Taylor**, Introduction to Management Science,** Chapter 9 Anderson et. al., **An Introduction to Management Science: Quantitative Approaches to Decision Making** Chapter 14 Class will be held in Lab	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).
14	Lecture 25 & 26: Case Problems for Application of AHP in different MCDM	Different Case Problems from Text Books	*Analyze* results and extract useful insights from the solutionsof the given decision problems (CLO 3).
15	Lecture 27 & 28: Regression analysis ▪ Introduction ▪ Simple Linear Regression ▪ Assumptions (linearity, independence, normality) ▪ Coefficient interpretation (slope, intercept) ▪ Model evaluation (R-squared, residual plots)	Instructor Notes Class to be held in Lab	*Solve* business problems by using appropriate quantitative models and techniques (CLO 2).
16	Lecture 29 & 30: Project Presentations	Project Reports & Presentation	*Defend* analysis in oral form toeffectively communicate solutions (CLO 4). *Apply* quantitative tools in real life scenarios and present solutions in written form. (CLO 5)
17	**PREPARATION WEEK (if required)**		
18	**FINAL EXAM WEEK**		