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CENTRE FOR ONLINE LEARNING

PIMPRI, PUNE

SYLLABUS FOR

MASTER OF BUSINESS ADMINISTRATION (M.B.A)

Academic Year 2025

Semester-III Business Analytics Specialization

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA301			**Type**	Specialization Course
Course Title	Business Analytics-I				

Course Description

Business Analytics is a combination of Data Analytics, Business Intelligence, and Computer Programming. It is the science of analyzing data to find out patterns that will be helpful in developing strategies. Its usage can be found in almost every industry. This introductory course in Business Analytics introduces the basic concept of Business Analytics. The later part of the course covers the concepts of Finance and Human Resource Analytics.

Course Objectives

1) To understand the concept of Business Analytics and its importance in business decisions and strategy formulation.
2) To learn various tools and techniques of Business Analytics used for solving complex business situations.
3) To learn functional analytics tools and metrics from Finance and Human Resource domain.
4) To apply Business Analytics skills to solve the real-life business situation.

Course Outline:

Part A Business Analytics

Unit 1 Business Research Analytics: Problem Identification, Define Business problem or opportunity, Data, Data and information, Types of data, primary data, Secondary data, Discrete data, continuous data, Data collection, Data collection methods and instruments, Measurement and scaling Techniques, Descriptive vs. Analytical statistics, Population and Sample, Sampling, sampling distribution, Estimation and hypotheses testing,

Unit 2 Introduction to Business Analytics: Analysis vs. Analytics, Introduction to Business Analytics, Business Analytics overview & origin, What is Business Analytics, Who is a Business Analyst (Functions). Concepts of Descriptive, Diagnostic, Predictive and Prescriptive Analytics, Types of IT companies. Types

of Development Units, IT hierarchy, Business Analyst Prerequisites. Roles and Responsibilities of a BA. Do's and Don'ts of a BA.

Unit 3 Business Analytics and Business Intelligence: Getting Started with Business Intelligence, Using Analytical Information for Decision Support, Information Sources Before Dawn of BI?, Business Intelligence (BI) Defined, Evolution of BI and Role of DSS, EIS, MIS, and Digital Dashboards, Need for BI at Virtually all Levels, BI for Past, Present, and Future, The BI Value Chain, Introduction to Business Analytics.BI Definitions and Concepts, BI Component Framework, Who is BI for?, BI Users, Business Intelligence Applications, BI roles, and Responsibilities, popular BI tools

Unit 4 Business Analytics techniques: Introduction to Requirements Analysis, Stakeholder Analysis, Trend Analysis, Comparative Analysis, Pareto analysis, process modeling, root cause analysis, Fish bone analysis, SWOT analysis, GAP analysis, PESTLE analysis, Value-based Analysis, Theory of constraint, Feasibility study, current state analysis, Define Future State, Business case writing.

Unit 5 IT and Business Analytics: Business View of Information Technology Applications, Business Enterprise Organization, Its Functions, and Core Business Processes, Baldrige Business Excellence Framework (Optional Reading), Key Purpose of Using IT in Business, The Connected World: Characteristics of Internet-ready IT Applications, Enterprise Applications (ERP/CRM, etc.) and Bespoke IT Applications, Information Users and Their Requirements.

Part B Financial Analytics

Unit 6 – Fundamentals of Financial Mathematics: Number system, fraction, percentage, profit, loss, Arithmetic, and geometric sequences and series, Simple interest, compound interest, and annual percentage rates, Depreciation, Time value of money, discounting, Net present value and internal rate of return, Annuities, debt repayments, sinking fund, The relationship between interest rates and the price of bonds.

Unit 7 Financial Risk Analytics: Concept of Risk, Risk management, Types of Risks, Financial Markets, Types of financial risks, Steps in Risk Management Process, Risk Analytics, operational risk, credit risk, model risk, market risk (price risk, currency risk, interest rate risk), Steps in Risk management, Selection of appropriate risk management techniques, Trade-off between risk and return, Risk-free rate, risk premium, Required rate of return, Holding period yield, holding period return, expected return, Types of Risks-Systematic risk vs unsystematic risk, measures of systematic risks, measures of unsystematic risks.

Unit 8 Valuation analytics: Discounted cash flow techniques, Relative valuation Techniques, equity valuation, DCF, DDM, Present value of operating cash flows, present value of free cash flows, Relative equity valuation-PE ratio, Price to earning growth ratio, Price to book value ratio, Price-sales ratio,

Valuation of fixed income securities, zero-coupon bond, coupon bond, YTM, Non- linear relationship between bond prices and interest rates, the sensitivity of fixed income securities, convexity.

Unit 9 Market risk management: Diversification, Concept of portfolio Modern portfolio Theory, Markowitz Portfolio optimization model, Sharpe Single Index model, CAPM, Arbitrage pricing model, portfolio evaluation, Adjusting portfolio Beta, Sharpe measure, Treynor's measure, Jensen's measure, portfolio revision, Basel Norms for Market Risk, VaR.

Part C Human Resource Analytics

Unit 10 Introduction to HR Analytics: Evolution of HR Analytics, understanding HR analytics, Models of HR analytics, Three-level model, (Prescriptive Analytics, Predictive and Descriptive Analytics),4 level model, Eight level model, IT in HRM, Workforce Analytics: definition, evolution, function of Workforce analytics, Use of HR metrics to measure results in HR - Process vs Outcome, Efficiency vs Effectiveness, Lead vs Lag, challenges in measuring human capital, HR Business Framework, Concept of Balanced Score Card, Identifying key workforce questions, Strategic Case for Workforce Analytics, Data Sources, Power of combining data sources, Good, Important & Key Metrics.

Unit 11 Recruitment Analytics: Introduction, Recruitment, and Selection, Job analysis, Use of data analytics in job analysis, Human resource planning, Use of HR analytics in recruitment, Use of analytics in the selection, Ratios, and Metrics used in the selection process, (Fill-up ratio, Full time, Time to hire, Early turnover, Turnaround time, Source of hire, Cost per hire, first-year resignation rate, the Satisfaction rate of hiring managers, Termination during probation, Channel efficiency mix in terms of Direct hires, Employee referral hires, Agency hires & Lateral hires, Offer reject and renege, Fulfilment ratio, Quality of hire, Recruitment to HR cost. Use of KPIs in the selection process, Use of Artificial Intelligence in Recruitment and selection.

Unit 12 Training, development, and efficiency Analytics: Training needs identification, Use of analytics in Training and development. ROI of behavioral training, Performance appraisal, Use of HR analytics in performance appraisal, (Various measures and ratios), Make or Buy Model, Training effectiveness evaluation, Percentage of the employee trained, Internally and externally trained, Training hours and cost per employee, the Competence level of employee, Use of metrics in talent management, Employee engagement analytics, Compensation management, and HR analytics, Analytics in expatriate management.

Unit 13 HR Cost and Performance Metrics: Revenue per employee, Operating cost per employee, PBT per employee, HR cost per employee, HR to operating cost, Compensation to HR cost, HR budget variance, HR ROI, Calculating HR KPI, Scorecard based on recruitment, training and development, Calculating HR KPI, Scorecard based on employee retention, and turnover. Predicting individual and team

turnovers, Turnover costs for business implications, Selection decisions from previous performance data, Predictive modelling of individual and team performance, Identifying flight-risk candidates, Report generation.

Course Outcome:

On successful completion of the course the learner will be able to:

CO#	Cognitive Abilities	Outcomes
CO 301.1	**Remember**	Learn and remember the meaning and concepts of Business Analytics, Predictive Analytics, and Prescriptive Analytics.
CO 301.2	**Understand**	Understand how various Business Analytics tools and methods can be fitted to various business situations.
CO 301.3	**Analyze**	Analyze the decision-making environment and various decision-making methods using Business Analytics
CO 301.4	**Apply**	Apply various Business Analytics Methods to solve complex business situations.

Suggested Reading:

1. Predictive HR Analytics: Mastering the HR Metric Paperback – 3 March 20161 by Dr. Martin Edwards (Author), Kirsten Edwards
2. Essential Mathematics for Economics and Business Paperback – 21 August 2006 by Teresa Bradley (Author), Paul Patton (Author)
3. Fundamentals of Business Analytics, 2ed by Seema Acharya R N Prasad
4. Quantitative Analytics in Debt Valuation & Management (PROFESSIONAL FINANCE & INVESTM) by Mark Guthner.
5. Business Analysis Techniques: 99 essential tools for success

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA302			**Type**	Specialization Course
Course Title	Business Analytics-II				

Course Description

This course introduces the learners with functional analytics in the domains of Marketing Management, Supply Chain Management, and Operations Management. There many metrics and measures related to these functional domains which facilitate decision-making through numeric data analysis.

Course Objectives

1) To understand the importance of marketing, supply chain, and operations metrics and analytics
2) To learn to analyze the data generated at various functional units in the firms.
3) To inculcate analytical decision-making based on scientific numerical data analysis.
4) To apply the concepts of Marketing, Supply Chain, and Operations analytics to solve complex business problems.

Course Outline:

Part A Marketing Analytics

Unit 1 Introduction to Marketing Analytics: Marketing Analytics, Data for marketing Analytics, Descriptive, Predictive, and Prescriptive analytics in marketing, Segmentation Analytics: Market Segmentation Variables, Market Segmentation Types, Marketing Data Landscape, Data for Segmentation, Analytics for Need-Based Segmentation – Cluster analysis, clustering algorithm of consumer data, RFM Analysis, Life Cycle Segmentation, Cross Tabulation Segmentation, Regression-based segmentation, Clustering, Conjoint Analysis Segmentation, The Cluster Analysis + Discriminant Analysis Approach.

Unit 2 Market positioning Analytics: Rationale for Segment Targeting, Analytics for Perceptual Mapping and Product Positioning, Determinant attributes, Multi-Dimensional Scaling (MDS) and Factor Analysis, Relevance of Mapping for Product Positioning, Preference Mapping, Incorporating Preferences in Perceptual Mapping.

Unit 3 Analytics for Product/Service Design: The Relevance of Trade-off Approaches, Conjoint Analysis, Approaches to Conjoint Analysis, Interpreting Conjoint Results, Optimizing Design using Conjoint Results. Forecasting, Applying diffusion model, marketing mix models.

Unit 4 Customer growth analytics: Rationale for Customer Analytics, Customer acquisition cost, Customer Churn, Customer Attrition models, Customer lifetime value, Net promoter score, Calculating the number of new customers, Calculating average customer age & Days to convert, Calculating customer acquisition cost & Average purchases, Calculating touch points & Lead conversion, Analyzing age demographics, First contact with customer, Customer satisfaction, Understanding customer engagement, Diffusion Models - The Bass Model, Metrics for tracking customer experiences, customer lifetime value, Churn rate.

Unit 5 Modeling New Marketing Initiatives: Introduction to modeling, Evaluating new ad channels, Modeling tips, and best practices, Projecting ad revenue, Projecting organic follower revenue, Projecting expenses, Calculating net profit and breakeven, Understanding ROI, Calculating returns, Creating a single-variable sensitivity table, Creating a multi-variable sensitivity table.

Part B Supply Chain and Operations Analytics

Unit 6 Introduction to Supply Chain Analytics: Supply chain management for competitive advantage, Pull and Push supply chain, Creating a Demand-Driven Supply Chain, Gaining Visibility across the Supply Chain, Resolving Operations Problems Premptively, Logistics, Supplier performance, Demand forecasting, Vendor Intelligence, Vendor Rankings, Fulfillment Intelligence, Inventory Diagnostics, Shrinkage.

Unit 7 Inventory Analytics: Inventory, dependent and independent demand, Reasons to keep inventory, Holding cost, Procurement cost, Stock out cost, Economic order quantity, Inventory levels, Safety stock analytics, Service level and product availability measures, Fill rate, lead time uncertainties, Inventory levels probabilistic model for desired customer satisfaction level, Material variance, Inventory classification with emphasis on ABC analysis.

Unit 8 Distribution Analytics: Constrained optimization models, Linear Programming Problem, Use of LPP, Transportation model, Single facility location- Centre of gravity model, Multiple facility location problem mathematical model for popular location models, Set covering problem, Maximal covering problem, P center problem, P-Dispersion problem, P median problem, capacitated fixed charge location problem.

Unit 9 Merchandising Analytics: Assortment planning, GeoSpatial Analytics, Product placement, Space Optimisation, Product adjacency, Aligning store-level assortment with demand, Category Intelligence, Developing dynamic retail assortments, and Prioritization of Product categories.

Unit 10 Operations Analytics: Operations planning and scheduling, material requirement planning, MRPII and ERP, Facility Layout, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, Two jobs and m - Machines Problems, Queuing theory and its applications in service operations.

Course Outcome:

On successful completion of the course the learner will be able to:

CO#	Cognitive Abilities	Outcomes
CO 302.1	**Remember**	Learn and remember the meaning and concepts of Descriptive, Predictive, and Prescriptive Analytics in Supply Chain, Marketing, and Operations domain
CO 302.2	**Understand**	Understand Business Analytics techniques of Marketing and Supply Chain Management.
CO 302.3	**Analyze**	Analyze the decision-making environment and various decision-making methods using Business Analytics
CO 302.4	**Apply**	Apply various Marketing, Supply Chain, and Operations Analytics to solve complex business situations.

Suggested Reading:

1. Marketing Analytics by Seema Gupta and Avadhoot Jathar, Wiley.
2. Marketing Analytics - For Strategic Decision-Making by Moutusy Maity and Pavankumar Gurazada, Oxford Publication.
3. Supply Chain Analytics: Using Data to Optimise Supply Chain Processes (Mastering Business Analytics)by Peter W. Robertson.
4. Supply Chain Planning and Analytics: The Right Product in the Right Place at the Right Time by Gerald Feigin.
5. Business Analytics in Production & Operations Management, by Soluade Oredola

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA303			**Type**	Specialization Course
Course Title	Data Base Management System				

Course Description

This course introduces learner's to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS and analyze complex business scenarios, create a data model. Understand basic SQL syntax and the rules for constructing valid SQL statements. This course will teach learners how to design, implement, and demonstrate a database solution for a business or organization.

Course Objectives

1) To excel in database design along with the basis which leads to the effective use of SQL.
2) To provide an environment that is both convenient and efficient to use in retrieving and storing database information.
3) Describe DBMS and its advantages and disadvantages.
4) Describe data models, schemas and instances, and data languages.
5) Develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.

Course Outline:

Unit 1: Database Basics: Database System- concepts and architecture: Need for DBMS, Characteristics of DBMS, Database Users, 3-tier Architecture of DBMS (Its Advantages over 2-tier), Views of Data-Schemas and Instances, Data Independence.

Unit 2: Modelling Techniques: Different Types of Models, Introduction to ERD, Entities, Relationships, Representation of Entities, Attributes, Relationship Set, Generalization, Aggregation, Specialization. Structure of Relational Database and Types of Keys, Expressing M: N Relation.

Unit 3: Relational Model & Relational Database Design: Data modeling using the Entity-Relationship (ER) modeling and Enhanced Entity-Relationship (EER) modeling. Codd's Rules, Relational Model Concept, Relational Model Constraints. ERD, Relational database design using ER to relational mapping, Relational algebra and relational calculus, Tuple Relational Calculus, Domain Relational Calculus, SQL.

Unit 4: Normalization: Normal Forms, Properties of relational decomposition, Functional Dependencies, Normalization, Normal Forms Based on Primary Keys, Loss Less Joins, and Dependency Preserving Decomposition. Algorithms for relational database schema design.

Unit 5: Transaction: Concept of Transaction, ACID properties, States of Transaction, Implementation of Atomicity & Durability. Transaction processing concepts: Schedules and serializability, Optimistic Concurrency Control, Two-Phase Locking Techniques, Time Stamp Based Protocols, Granularity of Data Items, Deadlock, Database recovery concepts, and techniques.

Unit 6: Data Storage and indexing: Single level and multi-level indexing, Dynamic Multi-level indexing using B Trees and B+ Trees, Query processing and Query Optimization, Introduction to database security.

Unit 7: Introduction To Oracle Architecture: Memory Structures and Processes, User and Server Processes, Database Structures.

Unit 8: SQL Querries, Sub Queries, and Correlated Query: Select with all Options, Operators, Arithmetic, Comparison, Logical (in, between, like, all, %, _, any, exists, is null, and, or, not, Distinct), Clauses.

Unit 9: SQL Functions: Date: Sys_date, next_day, Add_months, last_day, months_between; Numeric: Round, trunc, abs, ceil, cos, exp, floor; Character: Initcap, lower, upper, ltrim, rtrim, translate, length, lpad, rpad, replace; Conversion: to_char, to_date, to_number; Miscellaneous: Uid, User, nvl, vsize, decode, rownum; Group Function: avg, max, min, sum, count, with Group by and Having Clause.

Unit 10: SQL Statements: Statements: DML Statements (Insert, Update, Delete with where clause), TCL (Commit, Rollback, Savepoint), Locks in Oracle, DDL statements.

Unit 11: Working With Table: Table: Create, Alter, Drop, Truncate, Rename, Constraints (Primary key, Foreign Key, Unique Key, Check, Default, Not Null, On Delete, Cascade), Column Level and Table Level Constraints, Oracle Objects, Views, Sequences, Synonyms, Index (Define, Alter and Drop)

Course Outcome:

On successful completion of the course the learner will be able to:

CO#	Cognitive Abilities	Outcomes
CO303.1	**Remember**	Learn the basics of Database Management System and RDBMS
CO303.2	**Understand**	Understand data models, schemas and instances, and data languages.
CO303.3	**Apply**	Apply the knowledge in Business Environment in solving the problems
CO303.4	**Analyse**	Analyse different Data Models
CO303.5	**Evaluate**	Evaluate the knowledge by building a practical project

Suggested Reading:

1. Fundamentals of Database Systems By Pearson by Elmasri Ramez and Navathe Shamkant
2. Database Management Systems (Dbms) by Rajiv Chopra
3. Database System Concepts (McGraw-Hill International Editions Series)by Henry F. Korth and Abraham Silberschatz

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA304			**Type**	Specialization Course
Course Title	Business Statistics and Econometrics				

Course Description

This course is one of the important and inseparable parts of any Business Analytics and Data Science curriculum. The course includes the concepts of descriptive statistics, Inferential Statistics, and basic Econometrics. This course forms the basis for research, surveys, data collection, data processing, data analysis, and inferences. There are some Econometric methods as well which are highly useful in various managerial decisions such as forecasting.

Course Objectives

1) To gain basic understanding of descriptive and inferential statistics.
2) To understand various methods of data presentation and analysis for drawing useful inferences.
3) To inculcate the analytical decision-making approach among the learners.
4) To make learners apply the various statistical and Econometric methods in various business situations.

Course Outline:

Unit 1: Introduction to Classification and Presentation: Introduction to Statistics, Definition, functions, and limitations, Frequently used terms -Data, variable, Constants, Population and sample, Data collection, Measurement Scales, Classification of Data, Frequency distribution-Frequency distribution charts- discrete and continuous, Cumulative frequency distribution, Relative frequency distribution, Tabulation of data, Diagrammatic and graphical representation of data- Bar diagram-(Simple, Multiple, Component, percentage), Histogram, Frequency curve, Frequency polygon, Ogives, Pie-chart.

Unit 2: Averages and Dispersion: Measures of Central Tendency – Concept, Mean, Median, Mode for discrete and continuous series, properties, pros and cons of various measures of central tendency. Measures of Dispersion: Concept, Range, Inter-quartile range, Quartile deviation, Standard deviation, Variance, Mean deviation, Coefficient of variation. properties, pros, and cons of various measures of dispersion. Practical problems on averages and dispersion.

Unit 3: Relation between variables: Statistical versus Deterministic Relationships, Regression versus Causation, Regression versus Correlation Correlation Analysis– Scatter Plots, Some Misconceptions About

Correlation, Correlation Terminologies. Karl Pearsons's correlation coefficient, Spearman's Rank correlation coefficient, Partial and multiple correlations. Simple, partial, And Multiple Regressions. Association of Attributes: Notations, Classes, and Class Frequencies, Relationship, Between the Class Frequencies, Consistency of the Data, Independence of Attributes, Association of Attributes, Yules' Co-efficient of Association. , Chi-square crosstabulation

Unit 4: Probability & Probability Distribution: Notation and Terminology from Set Theory, Sample Space, Sample Points, and Events, Addition Theory of Probability, Multiplication Theory of Probability, Conditional Probability, Baye's Theorem, Applications of Bayes' Theorem, Probability distribution, the difference between frequency distribution and probability distribution, Shapes of distribution, Binomial Distribution, Poisson Distribution, Normal Distribution. Uniform distribution,

Unit 5: Sampling Fundamentals: Census and Sample Survey, Data collection methods, Measurement Scales, Important Scaling Techniques, Need for Sampling, Probability and Random Variables, Sampling fundamentals, Steps in Sampling Design, Sampling methods, Random variable, sampling errors, sampling distribution, standard error, Central limit Theorem, Sandler's A-test, Sampling Theory, sampling distribution of sample means, Sampling distribution of sample proportion, t-distribution, F-distribution, Chi-square distribution.

Unit 6: Statistical inference, the concept of Estimation, point, and Interval Estimation Estimating the population mean, Estimating population proportion, sample size determination, Hypotheses, the concept of null and alternative hypotheses, level of significance and confidence interval, Type I and Type II errors, one-tailed vs two-tailed hypotheses. Confidence-Interval. P-value, Acceptance region, Hypotheses testing procedure, Simple and composite hypotheses, Measuring the Power of a Hypothesis Test.

Unit 7: Hypotheses testing: Parametric methods-Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Testing the Equality of Variances of Two Normal Populations, Hypothesis Testing of Correlation Coefficients, Chi-square as a Test for Comparing Variance, Conditions for the Application of $\chi 2$ Test, Non-parametric methods of hypotheses testing- sign test, Fisher-Irwin test, Kendall's test, Kruskal-Wallis test, Spearman's Rank Correlation

Unit 8: Statistical inference in two variable regression models: Population Regression Function (PRF), Intrinsically linear regression model, The Sample Regression Function (SRF), Ordinary Least Squares method of estimation, assumptions of OLS, Properties of OLS estimators, Properties of OLS under Normality, Standard Errors of Least-Squares Estimates, BLUE, The Gauss–Markov Theorem, The

Coefficient of Determination r, Covariance Between βˆ 1 and βˆ 2, The Least-Squares Estimator of σ2, consistency of Least square Estimators. Maximum Likelihood Estimation of Two-Variable Regression Model, Confidence Intervals for Regression Coefficients β1 and β2, Testing the Significance of Regression, Hypothesis Testing:

Unit 9: Statistical inference in multiple regression models: Multiple regression model, statistical properties, Estimation of parameters, the matrix form of the multiple regression model, The Meaning of Partial Regression Coefficients, OLS and ML Estimation of the Partial Regression Coefficients, Goodness of fit R2 and the Adjusted R2, Hypothesis Testing in Multiple Regression, Testing the Overall Significance of the Sample Regression, Restricted Least Squares: Testing Linear Equality Restrictions, Functional Forms of Regression Models, Qualitative (dummy) independent variables

Unit 10: Violations of Assumptions: Multicollinearity Nature of Multicollinearity, presence of perfect and imperfectly high multicollinearity, Consequences of multicollinearity, Detection of Multicollinearity, Remedial Measures for Multicollinearity, Heteroscedasticity Meaning and Nature of Heteroscedasticity, OLS Estimation in the Presence of Heteroscedasticity, The Method of Generalized Least Squares (GLS), Consequences of Using OLS in the Presence of Heteroscedasticity, Detection of Heteroscedasticity, Remedial Measures for Heteroscedasticity. Autocorrelation, Nature of the Problem, OLS Estimation in the Presence of Autocorrelation, The BLUE Estimator in the Presence of Autocorrelation, Consequences of Using OLS in the Presence of Autocorrelation, Detecting Autocorrelation, Remedial measures, Correcting autocorrelation using GLS.

Unit 11 Forecasting- Time series analysis: Approaches to Economic Forecasting, AR, MA, and ARIMA Modeling of Time Series Data, The Box–Jenkins (BJ) Methodology, Identification, Estimation of the ARIMA Model, Diagnostic Checking, Forecasting, Vector Autoregression, Measuring Volatility in Financial Time Series: The ARCH and GARCH Models.

Course Outcome:

On successful completion of the course the learner will be able to:

CO#	Cognitive Abilities	Outcomes
CO 304.1	**Remember**	Learn and remember the meaning and concepts of descriptive statistics, statistical inference, and Econometrics
CO 304.2	**Understand**	Understand how various statistical and Econometric methods can be fitted to various business situations.
CO 304.3	**Analyze**	Analyze the decision-making environment and various decision-making methods.
CO 304.4	**Apply**	Apply various Statistical and Econometric Methods to solve complex business situations.

Suggested Reading:

1. Basic Econometrics by Damodar Gujarati, Dawn Porter, et al. 1 July 2017.
2. Introduction to Econometrics | Third Edition | By Pearson by H Stock James and W. Watson Mark
3. BUSINESS STATISTICS: Text and Problems - With Introduction to Business Analytics | 2nd Edition by N D Vohra. Statistics for Business & Economics, 13E by David R. Anderson, Dennis J. Sweeney, et al.

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA305			**Type**	Specialization Course
Course Title	Performing Analytics with Python				

Course Description

This course will take you from the basics of Python to exploring many different types of data. This course is designed to teach students how to analyze different types of data using Python. Learner's will know about how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations, predict future trends from data, and more.

Course Objectives

1) To understand the basic concepts of Python & its libraries
2) To understand Data Analytics using Python
3) To understand and use Python data science libraries as a tool for data analytics
4) To understand Data Modelling techniques.

Course Outline:

Unit-1 - Python Fundamentals for Data Analytics: Python data structures, data types, tuples, operators, Event-driven programming, local and global variables, buttons, and input fields - The canvas, static drawing, timers, interactive drawing -Lists, keyboard input, motion, positional/velocity control - Mouse input, more lists, dictionaries. Control statements, Functions, Object-Oriented programming concepts using classes, objects, and methods, Exception handling, Implementation of user-defined Modules and Packages, and File handling in python.

Unit-2 - Python Advance Concepts: Images - Classes, tiled images - Acceleration and friction, spaceship class, sprite class, sound - Sets, groups of sprites, collisions, sprite animation - Fundamentals of Data Manipulation with Python, RDBMS, UML.

Unit-3 - Python Libraries: Learn Numpy - a common scientific computation library, getting familiar with Pandas for structural data processing, Learn the common statistical data analysis techniques in python, Getting familiar with simple linear regression.

Unit-4: Introduction to Data Understanding and Preprocessing: Knowledge domains of Data Analysis, understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing

Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

Unit-5: Data Processing and Visualization: Data Formatting, Exploratory Data Analysis, Filtering, and hierarchical indexing using Pandas. Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

Unit-6: Mathematical and Scientific applications for Data Analysis: Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays.

Unit 7: Analysing Web Data: Data wrangling, Web scrapping, Combing and merging data sets, Reshaping and pivoting, Data transformation, String Manipulation, case study for web scrapping.

Unit-8: Analytics part - I: Basic nomenclature - Analytics process model - Analytics model requirements - Types of data sources – Sampling - types of data elements - Visual Data Exploration and Exploratory Statistical Analysis - Missing Values - Outlier Detection and Treatment - Standardizing Data – Categorization - weights of evidence coding - Variable selection – Segmentation.

Unit-9: Analytics part - II: Predictive Analytics: Target Definition - Linear Regression - Logistic Regression - Decision Trees - Neural Networks - Support Vector machines - Ensemble Methods - Multiclass Classification Techniques - Evaluating Predictive Models.

Unit-10: - Social Networking: Social Network Analytics: Social Network Definitions - Social Network Metrics - Social Network Learning -Relational Neighbor Classifier - Probabilistic Relational Neighbor Classifier -Relational logistic Regression - Collective Inference. Benchmarking - Data Quality - Software – Privacy - Model Design and Documentation - Corporate Governance. Example applications: Credit Risk Modeling - Fraud Detection - Recommender Systems - Web Analytics.

Unit-11 Value Addition: Web Analytics, Introduction to Machine Learning, Applications of Machine Learning.

Course Outcome:

On successful completion of the course the learner will be able to:

CO#	Cognitive Abilities	Outcomes
CO305.1	**Remember**	Learn the Basics of Python
CO305.2	**Understand**	Understand the Data Analytics using Python
CO305.3	**Analyze**	Analyze and implement various algorithms using Python
CO305.4	**Apply**	Design and develop an algorithm to solve business problems.

Suggested Reading:

1. Python Data Analytics With Pandas, NumPy, and Matplotlib, Second Edition. Fabio Nelli Publication Apress
2. Data Analysis From Scratch With Python Step By Step Guide: Peters Morgan
3. Social Media Analytics Strategy Using Data To Optimize Business Performance Author: Alex Gonçalves Publication: Apress

Semester	3	**Course Credits**	4	**Specialization**	Business Analytics
Course Code	OMBBA306			**Type**	Specialization Course
Course Title	R programming for Data Analysis and Visualization				

Course Description

The dependency of Business firms on data and information systems is continuously growing, a lot of raw data is generated on daily basis, which is meaningless unless analyzed and interpreted by using some sophisticated techniques. Data visualization provides a good, organized pictorial representation of the data which makes it easier to understand, observe, and analyze. In this course, learners will learn how to visualize data using R and its libraries to facilitate decision-making. Data visualization allows managers to gain insight into their vast amounts of data. It benefits them to recognize new patterns and errors in the data.

Course Objectives

1) To understand the importance of data analysis and visualization techniques for managers
2) To learn to analyze the descriptive statistics using R
3) To learn to test hypotheses to interpret data by using R package
4) To Understand what plots are suitable for a type of data managers encounter with while making decisions.
5) To Visualize data by creating various graphs using R base package, lattice, and ggplot2 packages

Course Outline:

Unit 1: Preliminaries and Introduction to R: What is R, Installing R and R studio, R studio overview, Working in the console, Arithmetic Operators, Logical Operations, Using Functions, Getting Help in R and Quitting RStudio, Types of variables, Creating variables, Using Variables, Numeric, character and Logical variables and operators, Sorting Numeric, Character, and Factor Vectors, Special Values, Using the console, Creating an object in R, Data types in R - Integers and doubles, Objects and Data Types, Coercion rules in R, Functions in R, Functions, and arguments, Objects and Functions, Packages in R, What is a Vector? create vectors, Naming a vector in R, Vector recycling, Vectorized operations, Slicing and indexing a vector in R, Extracting elements from a vector, Using the [] brackets, The power of vectorized operations, Changing the dimensions of an object in R

Unit 2: Matrices: Matrices, Creating Matrices in R, Naming Dimensions, colnames() and rownames(), Matrix Operations, Indexing an element from a matrix, Slicing a matrix in R, Matrix operations in R, Visualizing With Matplot(), Subsetting, Visualizing Subsets Creating a factor in R, Factors in R.

Unit 3: Fundamentals of Programming in R: Relational operators in R, Logical operators in R, Vectors and logical operators, If, else, else if statements in R, If, else, else if statements - Keep-In-Mind's, For loops in R, While loops in R, Repeat loops in R, Boolean logical operators, Building a function in R 2.0, Building a function in R 2.0 – Scoping, Creating functions, Calling functions, Exercise Scoping

Unit 4: R packages and scripts: Installing and loading packages, setting up your working directory, Downloading and importing data, Working with missing data, Extracting a subset of a data frame, Writing R scripts, Adding comments and documentation, Creating reports

Unit 5: Data Preparation: What are factors, gsub() and sub(), Dealing with Missing Data, What is an NA?, Way To Locate Missing Data, Data Filters: which() for Non-Missing Data, Data Filters: is. na() for Missing Data, Removing records with missing data, Resetting the dataframe index, Replacing Missing Data: Factual Analysis Method, Replacing Missing Data: Median Imputation Method (Part 1), Replacing Missing Data: Deriving Values Method, Visualizing results.

Unit 6: Data frames: Creating a data frame in R, Importing data into R, The Tidyverse package, Exploring your dataset, Using the $ sign, Basic operations with a Data Frame, Filtering a Data Frame, Introduction to qplot, Visualizing with Qplot, Building Dataframes, Merging Data Frames, Messy Data, Renaming Columns (Variable Names), Attaching / Detaching, Tabulating Data: Constructing Simple Frequency Tables, Ordering Factor Variables

Unit 7: Lists in R: Import Data Into R, Handling Date-Times in R, What is list, Naming components of a list, Extracting components lists: [] vs [[]] vs $, Adding and deleting components, Subsetting a list, Creating A Timeseries Plot, Apply Family of Functions, Import Data into R

Unit 8: What is Apply Family: Using apply(), Recreating the apply function with loops, Using lapply(), Combining lapply() with [], Adding your own functions, Using sapply(), Nesting apply() functions, which.max() and which.min

Unit 9: Advanced Visualization using R with GGplot2: Using the ggplot2package to visualize data, Grammar of Graphics- GGplot2, What is a Factor?, Aesthetics, Plotting With Layers, Overriding Aesthetics, Mapping vs Setting, Line chart, Bar charts, Histograms, and Density Charts, Pie chart Stacked Area Chart, Scatter plot, and Trendline, Starting Layer Tips, Statistical Transformations, Using Facets, Coordinates, Perfecting By Adding Themes, Applying themes from ggthemes to refine and customize charts and graphs, Building data graphics for dynamic reporting