

S.P. Mandali's

**R. A. PODAR COLLEGE OF COMMERCE AND
ECONOMICS (AUTONOMOUS),**

Matunga, Mumbai-400019

Course Structure

For

Post Graduate Program

M.Com. (Business Analytics)

Semester I & II

www.rapodar.ac.in

POs for Postgraduate Program (Business Analytics)

PO#	Program Objectives	Program Objectives Description
P01	Subject Matter Expertise	<p>Develop a strong foundation in business analytics methodologies, techniques, and tools.</p> <p>Acquire the skills to gather, analyze, and interpret data to drive informed business decisions.</p>
P02	Practical Knowledge and Innovative Thinking	<p>Master the concepts and techniques of data science, including data cleaning, data exploration, and predictive modeling.</p> <p>Apply statistical analysis and machine learning algorithms to extract insights and patterns from complex datasets.</p>
P03	Scientific Communication Proficiency	<p>Develop effective data visualization skills to present complex insights in a clear and compelling manner.</p> <p>Communicate data-driven findings and recommendations to stakeholders, facilitating informed decision-making.</p>
P04	Technological Competence	<p>Gain expertise in machine learning algorithms and data mining techniques to derive meaningful insights from large datasets.</p> <p>Apply predictive modeling and data mining to solve real-world business problems and optimize processes.</p>
P05	Ethical Practice	<p>Understand the ethical considerations in business analytics and apply ethical frameworks to data usage and decision-making.</p> <p>Promote responsible data collection, privacy protection, and compliance with ethical and legal guidelines.</p>

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**R. A. PODAR COLLEGE OF COMMERCE AND
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Syllabus

And

Question Paper Pattern of Course

Post Graduate Program

M.Com. (Business Analytics)

Semester I & II

Syllabus as per National Education Policy 2020
To be implemented from Academic Year 2023-2024

M.Com
(Business Analytics)

Under Choice Based Credit, Grading and Semester System
Course Structure

M.Com-I

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
<i>Mandatory</i>			<i>Mandatory</i>		
1	Introduction Business Analytics	06	1	Introduction to Financial Analytics	02
2	Introduction To Data Science- I	06	2	Data Visualization and Communication	06
3	Business Ethics	02	3	Data Science - II	06
<i>Electives</i>			<i>Electives</i>		
3	R – Lab Course	04	3	Python Data Science – Lab Course	04
<i>Research Methodology</i>			<i>Research Methodology</i>		
4	Research Methodology for Business	04	---	-----	
<i>On Job Training / Field Project</i>			<i>On Job Training / Field Project</i>		
			4	Business Analytics Based Projects	04
Total Credits		22	Total Credits		22

M.Com-II

No. of Courses	Semester III	Credits	No. of Courses	Semester IV	Credits
<i>Mandatory</i>			<i>Mandatory</i>		
1	Machine Learning and Mining Algorithms	06	1	Predictive Analysis	06
2	Financial Model – Based Analytics-I	06	2	Financial Model – Based Analytics- II	06
<i>Elective Courses(EC)</i>			<i>Elective Courses(EC)</i>		
3	*Any one courses from the following list of the courses A. Sales and Marketing Analytics B. Tools for Data Analytics Lab Course – II C. Financial Accounting and Analysis	04	3	*Any one courses from the following list of the courses A. International Financial Regulatory Bodies B. Supply Chain Design and Management C. Foundation of Behavioral Financial Analysis	04
RESEARCH METHODOLOGY			RESEARCH METHODOLOGY		
4	Statistical Tools and Techniques of Research	02	--	----	
RESEARCH PROJECT			RESEARCH PROJECT		
	Research Project/Internship	04		Research project	06
	TOTAL CREDITS	22		TOTAL CREDITS	22

Note: Project work is considered as a special course involving application of knowledge in solving/ analyzing/ exploring a real life situation/difficult problem. Project work would be of 06 credits. A project work maybe undertaken in any area of Elective courses.

*Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester I*

1. Introduction to Business Analytics

Modules at a Glance

SN	Modules/ Units	No. of Lectures
	Modules	
1	Basics of Business analytics	15
2	Visualization/ Data Issues	15
3	Introduction to Data Mining	15
4	Introduction to data communication	15
Total		60

SN	Objectives
1	To enable the learners to understand the scope of Business analytics in today's era
2	To provide information pertaining to basics and principles of Business analytics
3	To develop learning and analytical skills of the learners to enable them to for Data visualization of multidimensional data
4	To acquaint the learners with recent developments and trends in Business analytics

Course Outcome No.	Course Outcomes
CO 1	Analyze and interpret data visualization, recognizing its importance in conveying complex information effectively and efficiently.
CO 2	Acquire the skill to Compare and contrast structured, semi-structured, and unstructured data, appreciating the challenges and opportunities each type presents in analytics.
CO 3	Understand the importance of data quality, and learn strategies for dealing with missing or incomplete data to ensure accurate and reliable analysis.
CO 4	Evaluate the ethical and legal considerations in business analytics, recognizing the importance of responsible data usage and privacy protection.

SN	Modules/ Units
1	Basics of Business analytics
	Concept of analytics, Types of Analytics, Application fields - Marketing Analytics, Finance Analytics, HR Analytics, Operation Analytics, Retail Analytics, Healthcare Analytics, Supply Chain Analytics - Role of Data Scientist in Business & Society
2	Visualization/ Data Issues
	Organization/sources of data - Structured Vs Semi structured Vs Unstructured data, Importance of data quality - Dealing with missing or incomplete data - Data Classification Types of Data Sources- Data Warehouse Vs Databases, Relational Database vs Non-Relational Database, RDBMS Data structures, Columnar Data structures
3	Introduction to Data Mining
	Introduction to Data Mining -Data Mining meaning - Data Mining Process - Data mining tool - Market Basket Analysis, Association Rules and clustering, Decision trees, Random forests
4	Business analytics future trends
	Role of Artificial Intelligence in Business, Machine Intelligence, Competitive Intelligence, Text Mining, Web Analytics (Web content mining, Web usage mining, Web structure mining), Role of Intelligent Agents in e-business, e-commerce, m-commerce, Location Analytics, Intelligent Agent in search & retrieval, Personalization and Comparison), Social Networking Analysis, Big Data Tools & Techniques, Content Analytics (Sentimental Analysis & Opinion Analysis). Ethical and Legal considerations in Business Analytics

Suggested Readings

1. Essentials of Business Analytics: An Introduction to the methodology and its application, Bhimasankaram Pochiraju, Sridhar Seshadri, Springer
2. Ben Fry- Visualizing Data. Released December 2007. Publisher(s): O'Reilly Media, Inc.
3. An Introduction to Business Analytics, Ger Koole, Lulu.com, 2019

**Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester I**

2. Business Ethics

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Business Ethics	15
2	Indian Ethical Practices and Corporate Governance	15
Total		30

SN	Objectives
1	To familiarize the learners with the concept and relevance of Business Ethics in the modern era
2	To enable learners to understand the scope and complexity of Corporate Social responsibility in the global and Indian context

Course Outcome No.	Course Outcomes
CO 1	Understand the concept and importance of business ethics. Recognize the role of Indian ethos, ethics, values, and work ethos in shaping ethical behavior.
CO 2	Analyze various approaches to business ethics: Evaluate different ethical theories, including Friedman's Economic theory, Kant's Deontological theory, and Mill & Bentham's Utilitarianism theory, and understand how these theories guide ethical decision-making in business.
CO 3	Understand the evolution of corporate governance and its principles. Evaluate the corporate governance regulatory framework in India.
CO 4	Analyze, and Application ethical issues, make informed decisions, and contribute to the establishment of ethical practices and effective corporate governance within organizations.

SN	Modules/ Units
1	Introduction to Business Ethics
	Business Ethics – Concept, Characteristics, Importance and Need for business ethics. Indian Ethos, Ethics, and Values, Work Ethos. Sources of Ethics, Ethical dilemma in business. Ethics in Marketing and Advertising, Human Resources Management, Finance and Accounting, Production, Information Technology, Copyrights and Patents Various approaches to Business Ethics - Theories of Ethics- Friedman’s Economic theory, Kant’s Deontological theory, Mill & Bentham’s Utilitarianism theory Gandhian Approach in Management and Trusteeship, Importance and relevance of trusteeship principle in Modern Business, Gandhi’s Doctrine of Satya and Ahimsa.
2	Indian Ethical Practices and Corporate Governance
	Corporate Governance: Concept, Importance, Evolution of Corporate Governance, Principles of Corporate Governance, Regulatory Framework of Corporate Governance in India, SEBI Guidelines and Clause 49, Audit Committee, Role of Independent Directors, Protection of Stake Holders, Changing roles of corporate Boards. Elements of Good Corporate Governance, Failure of Corporate Governance and its consequences

Suggested Readings

- Sharma J.P ‘ Corporate Governance, business ethics and CSR, Ane Books Pvt Ltd, New Delhi
- Sharma J.P. Corporate Governance and Social Responsibility of business, Ane Books Pvt ltd, New Delhi
- S.K.Bhatia, Business Ethics and Corporate Governance
- William Shaw, Business Ethics, Wordsworth Publishing Company, International ThomsonPublishing Company.
- Corporate Crimes and Financial Frauds, Dr. Sumit Sharma, New Delhi India
- R.C. Sekhar, Ethical choices in Business, Sage Publications, New Delhi
- Business Ethics, Andrew Crane and Dirk Matten, Oxford University Press.
- Business Ethics, Text and Cases, C.S.V. Murthy, Himalaya Publication House.
- Mallin, Christine A. Corporate Governance (Indian Edition) Oxford University press. New Delhi
- Blow field ,Michael and Alan Murray, Corporate Responsibility, Oxford University Press,
- Philip Kotler and Nancy Lee, CSR : doing the most good for Company and your cause , Wiley 2005
- Beeslory, Michel and Evens, CSR , Taylor and Francis, 1978
- Subhabrata Bobby Banerjee, CSR: the good, the bad and the ugly. Edward Elgar Publishing 2007
- Joseph A. Petrick and John F. Quinn, Management Ethics- Integrity at work , Sage Publication , 1997
- Francesco Perrini, Stefano and AntanioTencati, Developing CSR- A European Perspective , Edward

*Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester I*

3. Introduction to Data Science I

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction	15
2	Data Collection and Data Pre-Processing	15
3	Model Development	15
4	Model Evaluation	15
Total		60

SN	Objectives
1	To familiarize the learners with the concept and Foundation of Data Science
2	To enable learners to understand the scope and complexity of data science

Course Outcome No.	Course Outcomes
CO 1	Learn the importance of data pre-processing in ensuring data quality, consistency, and compatibility for analysis.
CO 2	Recognize the issues of overfitting and underfitting and their impact on model performance. Select appropriate models using model selection techniques.
CO 3	Applying polynomial regression and using pipelines for data preprocessing and modeling. Understand the benefits and limitations of these techniques.
CO 4	Understand the limitations and uncertainties associated with predictions based on regression models.

SN	Modules/ Units
1	Introduction to Data Science
	What is Data Science? Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.
2	Data Collection and Data Pre-Processing
	Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.
3	Model Development
	Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making
4	Model Evaluation
	Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Suggested Readings

- Jojo Moolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
- Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O’Reilly, 2015.
- David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
- Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

*Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester I*

3. R– Lab course

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to R	15
2	Matrices, Arrays and Data Frames	15
Total		30

SN	Objectives
1	To enable the students to know about the information needs of Management
2	To introduce the concepts of data analysis methods
3	To have hands-on training of Statistical Data Analysis through R Programming and Python Programming

Course Outcome No.	Course Outcomes
CO 1	Evaluate the Manipulate matrices: Create and manipulate matrices in R, and perform operations such as addition, subtraction, and multiplication. Understand the fundamentals of R: Describe the basic features and functionalities of the R programming language and environment.
CO 2	Understand the fundamentals of R: Describe the basic features and functionalities of the R programming language and environment.
CO 3	Understand the concept of arrays in R and perform array operations, including reshaping, indexing, and slicing arrays for data manipulation and analysis.

SN	Modules/ Units
1	Introduction to R
	Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorised operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names
2	Matrices, Arrays and Data Frames
	Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables
3	Series and data Frame
	The Series Data Structure, Querying a Series, The DataFrame Data Structure, DataFrame Indexing and Loading, Querying a DataFrame, Indexing Dataframes, Merging Dataframes , Data
	Aggregation and Group Operations, Time Series, Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Time Zone Handling, Periods and Period Arithmetic, Resampling and Frequency Conversion, Time Series Plotting, Moving Window Functions

Suggested Readings

1. "R Cookbook", Paul Teetor
2. "R for Data Science", Garrett Golemund and Hadley Wickham
3. "Hands-On Programming with R", Garrett Golemund
4. "An Introduction to Statistical Learning: With Applications in R", Daniela Witten, Gareth James Robert Tibshirani, and Trevor Hastie
5. "Introduction to Machine Learning with Python: A Guide for Data Scientists", Andreas C. Muller and Sarah Guido

**Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester I**

5. Research Methodology for Business

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Research	15
2	Research Process	15
3	Data Processing and Statistical Analysis	15
4	Research Reporting and Modern Practices in Research	15
Total		60

SN	Objectives
1	To enhance the abilities of learners to undertake research in business & social sciences
2	To enable the learners to understand, develop and apply the fundamental skills in formulating research problems
3	To enable the learners in understanding and developing the most appropriate methodology for their research
4	To make the learners familiar with the basic statistical tools and techniques applicable for research

Course Outcome No.	Course Outcomes
CO 1	Understand the research process: Identify the key components of the research process, including formulating research questions or hypotheses, designing research studies, collecting data, analysing data, and drawing conclusions. Recognize the importance of ethical considerations in research.
CO 2	Apply data processing techniques: Utilize appropriate techniques for data processing, including data cleaning, data coding, data entry, and data transformation, to ensure data quality and integrity for analysis.
CO 3	Interpret statistical results: Interpret the results of statistical analysis in the context of research questions or hypotheses, and effectively communicate the findings in a clear and meaningful manner.
CO 4	Develop effective research communication: Develop effective oral and written communication skills to present research findings, including creating research posters, delivering presentations, and writing research reports or academic papers.

SN	Modules/ Units
1	Introduction to Research
	Features and Importance of research in business, Objectives and Types of research- Basic, Applied, Descriptive, Analytical and Empirical Research. Formulation of research problem, Research Design, significance of Review of Literature Hypothesis: Formulation, Sources, Importance and Types Sampling: Significance, Methods, Factors determining sample size
2	Research Process
	Stages in Research process Data Collection: Primary data: Observation, Experimentation, Interview, Schedules, Survey, Limitations of Primary data Secondary data: Sources and Limitations, Factors affecting the choice of method of data collection. Questionnaire: Types, Steps in Questionnaire Designing, Essentials of a good questionnaire
3	Data Processing and Statistical Analysis
	Data Processing: Significance in Research, Stages in Data Processing: Editing, Coding, Classification, Tabulation, Graphic Presentation Statistical Analysis: Tools and Techniques, Measures of Central Tendency, Measures of Dispersion, Correlation Analysis and Regression Analysis. Testing of Hypotheses – Parametric Test-t test, f test, z test Non-Parametric Test -Chi square test, ANOVA, Factor Analysis Interpretation of data: significance and Precautions in data interpretation
4	Research Reporting and Modern Practices in Research
	Research Report Writing: Importance, Essentials, Structure/Layout, Types References, and Citation Methods: APA (American Psychological Association) Footnotes and Bibliography Modern Practices: Ethical Norms in Research, Plagiarism, Role of Computers in Research

Suggested Readings

1. Research Methodology – Text and Cases with SPSS Applications, by Dr S.L. Gupta and HiteshGupta, International Book House Pvt Ltd
2. Business Research Methodology by T N Srivastava and Shailaja Rego, Tata Mcgraw Hill Education Private Limited, New Delhi
3. Methodology of Research in Social Sciences, by O.R. Krishnaswami, Himalaya Publishing House
4. Research Methodology by Dr Vijay Upagude and Dr Arvind Shende
5. Business Statistics by Dr S. K Khandelwal, International Book House Pvt Ltd
6. Quantitative Techniques by Dr S. K Khandelwal, International Book House Pvt Ltd
7. SPSS 17.0 for Researchers by Dr S.L Gupta and Hitesh Gupta, 2nd edition, Dr S. K Khandelwal, International Book House Pvt Ltd
8. Foundations of Social Research and Econometrics Techniques by S.C. Srivastava, Himalaya publishing House
9. Statistical Analysis with Business and Economics Applications, Hold Rinehart & Wrintston, 2nd Edition, New York
10. Business Research Methods, Clover, Vernon T and Balsely, Howard L, Colombus O. Grid, Inc
11. Business Research Methods, Emary C.Willima, Richard D. Irwin In. Homewood
12. Research Methods in Economics and Business by R. Gerber and P.J. Verdoom, The Macmillan Company, New York Research and Methodology in Accounting and Financial Management, J.KCourtis
13. Statistics for Management and Economics, by Menden Hall and Veracity, Reinmuth J.E
14. Panneerselvam, R., Research Methodology, Prentice Hall of India, New Delhi, 2004.
15. Kothari CR, Research Methodology- Methods and Techniques, New Wiley Ltd., 2009

EXAMINATION PATTERN

(Under Choice Based Credit, Grading and Semester System)

(With effect from Academic Year: 2023-2024)

(Evaluation pattern)

1. Continuous Internal Evaluation System:

Continuous Internal Evaluation (CIE)	40 Marks
<p>The internal evaluation of 40 marks for M.Com for each semester would be of tests and of class participation, project, case study analysis, Case lets, PowerPoint presentations, group discussion, book review, Research paper, article analysis and any other mode depending on the nature and scope of the course. Continuous Internal Evaluation (CIE), to be conducted by the subject teacher all through the semester. The total mark break up would be suitably divided and the total marks scored by the learner would be submitted to the Controller of Examination.</p>	

2. Question Paper Pattern (Practical Courses) :

Maximum Marks: 60

Questions to be Set: 04

Durations: 02 hrs

All Questions are compulsory carrying 15 Marks each:

Question No.	Particulars	Marks
Q1	A) Practical/ Theory Question	15 Marks
	OR	
Q2	B) Practical/ Theory Question	15 Marks
	A) Practical/ Theory Question	15 Marks
Q3	OR	
	B) Practical/ Theory Question	15 Marks
Q4	A) Practical/ Theory Question	15 Marks
	OR	
Q4	B) Practical/ Theory Question	15 Marks

Note: Full-Length questions of 15 Marks may be divided into two sub-questions of 08 and 07 marks.

**Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester II**

Introduction to Financial Analytics

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Financial Analytics	15
2	Financial Modeling	15
3	Financial Securities	15
4	Emerging Trends	15
Total		60

SN	Objectives
1	To equip students with an understanding of the "importance and role of financial analytics" in modern business enterprises and how business firms can take advantage of financial analytics.
2	Students who wish to specialize in analytics, the course provides a strong foundation in the application of financial analytics with analytical platforms.

Course Outcome No.	Course Outcomes
CO 1	Acquire the skills of applying financial analytics techniques to analyse financial data and make informed decisions.
CO 2	Develop the skill of Continuously learning and adapting to new developments in the field of financial analytics to stay relevant in a dynamic business environment.
CO 3	Understand the ethical considerations and legal regulations related to financial analytics and data privacy.
CO 4	Develop the knowledge of using appropriate tools and technologies for financial analytics, including software applications and data visualization tools.

SN	Modules/ Units
1	Introduction to Financial Analytics
	Introduction: Meaning- scope and relevance of Financial Analytics uses- Features-Documents used in Financial Analytics: Balance Sheet, Income Statement, Cash flow statement-Elements of Financial Health: Liquidity, Leverage, Profitability. Recent trends in financial analytics
2	Financial Modeling
	Financial statement analysis and their interlinking, Equity and bond analysis, Valuation of equity and business (firm), basic portfolio analysis, project finance modelling, risk-return modelling, capital structure analysis, dividend policy and derivatives analytics.
3	Financial Securities
	Financial Securities: Bond and Stock investments - Housing and Euro crisis - Securities Datasets and Visualization - Plotting multiple series. Time Series and Sharpe ratio - Sharpe Ratio for Income Statement growth.
4	Emerging Trends
	Fintech: IT-enabled financial innovations and the current trend, Emerging Fintech techniques – Social trading, P2P lending, Blockchain, Algorithm trading basics

References:

- Business Analytics for Managers - GEAT H.N.LAURSEN JESPER THORLUND,
- Fundamentals of Business Analytics -R N Prasad,. Seema Achavya, Wiley India Pvt Ltd,New Delhi,
- Financial Analytics with R _ Mark J. Bennets, Cambridge University Press
- Fundamentals of Business Analytics - R N Prasad Seema Achavya, Cengage Learning, NewDelhi,
- Journal of Marketing Analytics, Springer
- Financial Analysts Journal, Taylor & Francis

**Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester II**

2. Data Visualization and Communication

Modules at a Glance

SN	Modules/ Units	No. of Lectures
	Modules	
1	Basics of Data Visualization	15
2	Principles of Data Visualization	15
3	Data visualization of multidimensional data	15
4	Introduction to data communication	15
	Total	60

SN	Objectives
1	To enable the learners to understand the scope of Data Visualisation and Communication in today's era
2	To provide information pertaining to basics and principles of Data Visualisation and Communication
3	To develop learning and analytical skills of the learners to enable them to for Data visualization of multidimensional data
4	To acquaint the learners with recent developments and trends in Data Visualisation and Communication

Course Outcome No.	Course Outcomes
CO 1	Acquire the skills to identify patterns, trends, and relationships in complex data sets through visualization. Communicate data effectively to different audiences, considering their needs and level of understanding.
CO 2	Understand the role of context and audience in data communication and adapt visualizations accordingly.
CO 3	Develop the understanding of being updated with emerging trends and technologies in data visualization for continuous improvement and innovation.
CO 4	Learn how to create visually appealing and informative data visualizations using appropriate tools and techniques.

SN	Modules/ Units
1	Basics of Data Visualization
	Introduction to Data Visualization, Challenges of Data Visualization, Definition and Types of Dashboard, Evolution of Dashboard, Dashboard Design and Principles, Display Media for Dashboard, Types of Data Visualization: Basic Charts Scatter Plots, Histogram, Advanced Visualization Techniques Like Streamline and Statistical Measures, Plots, Graphs, Networks, Hierarchies, Reports.
2	Principles of Data Visualization
	The Seven Stages of Visualizing Data: Why Data Display Requires Planning, Iteration and Combination, Principles, Getting Started with Processing: Sketching with Processing, Exporting and Distributing Your Work, Examples and Reference, Functions, Sketching and Scripting, Mapping: Drawing a Map, Locations on a Map, Data on a Map Using Your Own Data.
3	Data visualization of multidimensional data
	Need of Data Modeling, Multidimensional Data Models, Mapping of High Dimensional Data into Suitable Visualization Method-Principal Component Analysis, Clustering Study of High Dimensional Data, Visualization Tools.
4	Introduction to data communication
	Data Communication, Networks, Protocols and Standards, Standards Organizations. Line Configuration, Topology, Transmission Modes, Categories of Networks Internetworks, Study of OSI and TCP/IP protocol suit, The Model, Functions of the layers, TCP/IP Protocol Suites

Suggested Readings

- Alice Zheng- Evaluating Machine Learning Models: A Beginner's Guide to Key Concepts and Pitfalls, O'Reilly Media, 2015,
- Big data black book, Dream Tech Publication.
- Ben Fry- Visualizing Data. Released December 2007. Publisher(s): O'Reilly Media, Inc.
- Data Science Using Python and R by Chantal D. Larose and Daniel T. Larose, Wiley Publication.
- Python for Data Science and Visualization -Beginners to Pro, Udemy.
- Data communication & Networking by Bahrouz Forouzan.
- Data and Computer Communications by William Stallings

**Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester II**

3. Data Science II

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction	15
2	Data Processing	15
3	Basic Machine Learning Algorithms	15
4	Clustering	15
Total		60

SN	Objectives
1	To familiarize the learners with the concept and <i>Foundation of Data Science</i>
2	To enable learners to understand the scope and complexity of data science
3	To Handle Missing Or Inconsistent Data Using Appropriate Data Processing Methods.
4	To Use relevant tools and software for data processing, machine learning, and clustering tasks.

Course Outcome No.	Course Outcomes
CO 1	Develop the knowledge of understanding the fundamental concepts and processes involved in data processing, machine learning algorithms, and clustering
CO 2	Acquire the skills to select and apply appropriate data processing, machine learning, and clustering techniques for specific tasks and datasets
CO 3	Learn how to communicate and present the results of data processing, machine learning, and clustering analyses effectively.
CO 4	Understand the practical applications and potential benefits of data processing, machine learning, and clustering in various domains.

SN	Modules/ Units
1	Introduction
	Big Data and Data Science – Datafication – Current landscape of perspectives – Skill sets needed; Matrices – Matrices to represent relations between data, and necessary linear algebraic operations on matrices -Approximately representing matrices by decompositions (SVD and PCA).
2	Data Processing
	Data cleaning – data integration – Data Reduction Data Transformation and Data Discretization. Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves- Exploratory Data Analysis – Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA – The Data Science Process.
3	Basic Machine Learning Algorithms
	Association Rule mining - Linear Regression- Logistic Regression - Classifiers - k-Nearest Neighbours (k-NN), k-means -Decision tree - Naive Bayes- Ensemble Methods - Random Forest. Feature Generation and Feature Selection - Feature Selection algorithms - Filters; Wrappers; Decision Trees; Random Forests.
4	Clustering
	Clustering: Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN - Relative merits of each method - clustering tendency and quality.

Suggested Readings

- Cathy O’Neil and Rachel Schutt, “Doing Data Science, Straight Talk from The Frontline”, O’Reilly, 2014.
- Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition. ISBN 0123814790, 2011.
- Mohammed J. Zaki and Wagner Miera Jr, “Data Mining and Analysis: Fundamental Concepts and Algorithms”, Cambridge University Press, 2014.
- Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O’Reilly, 2016.
- Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015.

*Revised Syllabus of Courses of Master of Commerce (M.Com) Business Analytics
Program at Semester II*

Python for Data Science- Lab course

Modules at a Glance

SN	Modules	No. of lectures
1	Introduction to Python	15
3	Functions	15
4	Data Manipulation and Visualization	15
Total		45

SN	Objectives
1	To Understand and critically apply the concepts and methods of business analytics
2	To Strategic understand business analytics and be able to consider the relationships between this discipline and other areas of business to make holistic judgments when analyzing business situations
3	To Interpret and evaluate the results of clustering algorithms.

SN	Modules
1.	Introduction to Python
	<p>Introduction of Python, Jupyter Notebook, Python Functions, Python Types and Sequences, Python Moreon Strings, Reading and Writing CSV files</p> <p>Introduction to Python Language: Overview, Features of Python, Execution of a Python Program, Innards of Python, Frozen Binaries, Python Interpreter, Comparison of Python with C and Java, Installing Python, Writing & Executing, IDLE. Data Types, Variables And Other Basic Elements: Comments, Docstrings, Data types-Numeric, Compound, Boolean, Dictionary, Sets, Mapping, Basic Elements of Python, Variables Input and Output Operations: Input Function, Output Statements, Command Line Arguments Control Statements: Control Statements- Loop Statement, The else Suite, break Statement, continue Statement, pass Statement, assert Statement, return Statement</p>
2.	Series and data Frame
	<p>The Series Data Structure, Querying a Series, The Data Frame Data Structure, Data Frame Indexing and Loading, Querying a Data Frame, Indexing Data frames, Merging Data frames, Data Aggregation and Group Operations, Time Series, Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Time Zone Handling, Periods and Period Arithmetic, Resampling and Frequency Conversion, Time Series Plotting, Moving Window Functions</p>
3.	Functions
	<p>Functions: Defining & Calling a Function, Returning Results, Returning Multiple Values, Built-in Functions, Parameters and Arguments, Recursive Functions, Anonymous or Lambda Functions Operators: Arithmetic operators, Assignment operators, Unary minus operator, Relational operators, Logical operators, Bitwise operators, Membership operators, Identity operators, Precedence of Operators, Associativity of Operators Arrays: Creating Arrays, Indexing and Slicing, Basic Array Operations, Arrays Processing, Mathematical Operations on Array, Aliasing Arrays, Slicing and Indexing in NumPy Arrays, Basic Slicing. Advanced Indexing. Dimensions of Arrays, Attributes of an Array, Strings: Creating Strings, Functions of Strings, Working with Strings, Length of a String, Indexing & Slicing, Repeating & Concatenation of Strings, Checking Membership, Comparing Strings, Removing Spaces, Finding Substrings, Counting Substrings, Strings are Immutable, Splitting and Joining Strings, Changing Case, Checking Starting and Ending of a String, Sorting & Searching in the Strings, Formatting the Strings, Working with Characters</p>
4.	Data Manipulation and Visualisation
	<p>Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series. High-Performance Pandas: eval() and query()</p> <p>Visualization with Matplotlib: Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn</p>

REFERENCES:

- “Learning Python”, David Ascher and Mark Lutz
- “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and I Python”, Wes McKinney
- “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Andreas C. Muller and Sarah Guido

Syllabus of Courses of Master of Commerce (M.Com)
BUSINESS ANALYTICS Program at
Semester II

5.Business Analytics Related Project

Inclusion of project work in the course curriculum of the M.Com. programme is one of the ambitious aspects in the programme structure. The main objective of inclusion of project work is to inculcate the element of research work challenging the potential of learner as regards to his/ her eager to enquire and ability to interpret particular aspect of the study in his/ her own words. It is expected that the guiding teacher should undertake the counselling sessions and make the awareness among the learners about the methodology of formulation, preparation and evaluation pattern of the project work.

Guidelines for preparation of Project Work

Work Load

Work load for Project Work is 01 (one) hour per batch of 15-20 learners per week for the teacher. The learner (of that batch) shall do field work and library work in the remaining 03 (three) hours per week.

1. General guidelines for preparation of project work based on Business Analytics

- The project topic may be undertaken in any area of Elective Courses.
- Each of the learners has to undertake a Project individually under the supervision of a teacher-guide.
- The learner shall decide the topic and title which should be specific, clear and with definite scope in consultation with the teacher-guide concerned.
- University/college shall allot a guiding teacher for guidance to the students based on her / his specialization.
- The project report shall be prepared as per the broad guidelines given below:
 - Font type: Times New Roman
 - Font size: 12-For content, 14-for Title
 - Line Space : 1.5-for content and 1-for in table work
 - Paper Size: A4
 - Margin : in Left-1.5, Up-Down-Right-1
- The Project Report shall be bounded.
- The project report should be 60 to 80 pages

EXAMINATION PATTERN

**(Under Choice Based Credit, Grading and Semester System)
 (With effect from Academic Year: 2023-2024)
 (Evaluation pattern)**

3. Continuous Internal Evaluation System:

Continuous Internal Evaluation (CIE)	40 Marks
<p>The internal evaluation of 40 marks for M.Com for each semester would be of tests and of class participation, project, case study analysis, Case lets, PowerPoint presentations, group discussion, book review, Research paper, article analysis and any other mode depending on the nature and scope of the course. Continuous Internal Evaluation (CIE), to be conducted by the subject teacher all through the semester. The total mark break up would be suitably divided and the total marks scored by the learner would be submitted to the Controller of Examination.</p>	

4. Question Paper Pattern (Practical/ Theory Courses) :

Maximum Marks: 60

Questions to be Set: 04

Durations: 02 hrs

All Questions are compulsory carrying 15 Marks each:

Question No.	Particulars	Marks
Q1	A) Practical/ Theory Question	15 Marks
	OR	
Q2	B) Practical/ Theory Question	15 Marks
	A) Practical/ Theory Question	15 Marks
Q3	OR	
	B) Practical/ Theory Question	15 Marks
Q4	A) Practical/ Theory Question	15 Marks
	OR	
Q4	B) Practical/ Theory Question	15 Marks

Note: Full-Length questions of 15 Marks may be divided into two sub-questions of 08 and 07 marks.
