

243MBIDR2	Seminar/Live Project	241/MBABA/IDR302	-	-	35	15	50	2
Discipline Specific Elective Course[#]								
243MBDSE1	Predictive Modeling	241/MBABA/DSEC301	-	-	50	25	75	3
243MBDSE2	Statistics with R	241/MBABA/DSEC302	-	-	50	25		
Specialization Specific Elective Courses^{##}								
243MBBA1	Social Media Analytics	241/MBABA/SSEC301	50	25	-	-	75	3
243MBBA2	Relational Database Management and SQL	241/MBABA/SSEC302	-	-	50	25		
243MBBA3	Text Mining using NLP and Machine Learning	241/MBABA/SSEC302	-	-	50	25		
Total							850	31

*Each student is required to opt at least one course from MOOC of equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 35 marks will be for the certificate earned (external practical) and 15 marks will be allotted on the basis of internal (internal practical) viva.

Students have to elect one Discipline Specific Elective Course based on their interest.

Students have to select any two Specialization Specific Elective Courses based on their interest.

MBA Second Year Fourth Semester (Total Credits: 28, Marks - 700)

Course Code	Course Title	Course ID	Theory Marks		Practical Marks		Total Marks	Credits
			External Marks	Internal Marks	External Marks	Internal Marks		
Core Courses								
244MBCC1	Entrepreneurship and Innovation	241/MBABA/CC401	70	30	-	-	100	4
244MBCC2	Big Data Analysis	241/MBABA/CC402	-	-	70	30	100	4
Multidisciplinary Course								
	To be picked up from the pool OR Equivalent MOOC Course*						75	3
Ability Enhancement Course								
	To be picked up from the pool OR Equivalent MOOC Course**						50	2
Internship/ Dissertation/ Research Project								
244MBIDR1	Specialization based Research Project	241/MBABA/IDR401	-	-	100	50	150	6
Discipline Specific Elective Course[#]								
244MBDSE1	SaS and Tableau	241/MBABA/DSEC401	-	-	50	25	75	3
244MBDSE2	Machine Learning & Artificial Intelligence	241/MBABA/DSEC402	50	25	-	-		

Specialization Specific Elective Course##								
244MBBA1	Natural Language Processing	241/MBABA/SSEC401	50	25	-	-		
244MBBA2	Python Programming	241/MBABA/SSEC402	-	-	50	25	75	3
244MBBA3	Cloud Computing	241/MBABA/SSEC403	-	-	50	25		
Total							700	28
<p>*Each student is required to opt at least one course from MOOC for equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 50 marks will be for the certificate earned (external practical) and 25 marks will be allotted on the basis of internal (internal practical) viva.</p> <p>**Each student is required to opt at least one course from MOOC for equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 35 marks will be for the certificate earned (external practical) and 15 marks will be allotted on the basis of internal (internal practical) viva.</p> <p># Students have to elect one Discipline Specific Elective Course based on their interest.</p> <p>## Students have to select any two Specialization Specific Elective Courses based on their interest.</p>								

Specialization Based Research Project: During the 4th semester the students will have to work on a research project of their specialized area under the supervision of faculty member of the department. Each student will be required to submit a project report to the department for the work undertaken for evaluation in the 4th semester. Internal evaluation of 50 marks will be done by Internal Guide /Mentor and 100 marks will be based on External viva before the committee of three members constituted by the Dean/Chairperson of the Department.

Notes:

1. PLP Stand for Personal Leadership Programme
2. It is mandatory to teach at least two cases per subject per semester.
3. Spreadsheet is the recommended software for doing basic calculations in subjects applicable, hence shall be used for teaching, practice, problem solving and assignments during all the four semesters.
4. The duration of all the end term theory examinations shall be 3 hours

Instructions for the Examiner:

Instructions for the External Examiner: The question paper shall be divided in two sections as follows:

	Theory Marks	70	50	35
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Machine Learning categories: Supervised, Unsupervised and Reinforcement learning. Framework for building ML Systems-KDD process model, CRISP-DM & SEMMA, Machine learning Python packages, Machine Learning Core Libraries. Introduction to Cognitive Intelligence, Features of Cognitive Intelligence

Unit IV

Supervised and Unsupervised Learning: Supervised Learning: Introduction to classification, Linear Regression, Metrics for evaluating linear model, Multivariate regression, Non-Linear Regression, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Model Evaluation, Applications of supervised learning in multiple domains. Unsupervised Learning: Clustering, Hierarchical clustering, Partitioning Clustering- K-mean clustering, Applications of unsupervised learning in multiple domains.

SUGGESTED READINGS:

1. Richard Duda, Peter Hart and David Stork, "Pattern Classification," John Wiley & Sons.
2. Tom Mitchell, "Machine Learning." McGraw-Hill.
3. Richard Sutton and Andrew Barto, "Reinforcement Learning: An introduction," MIT Press.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning," Springer.

Mapping Matrix of Course: 243MBBA3

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBBA3: Text Mining using NLP and Machine Learning

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

241/MBABA/CC401

Fourth Semester

Entrepreneurship and Innovation

244MBCC1

Credit: 4

External Marks: 70

Internal Marks: 30

Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives:

The course provides a framework for comprehending the process of forming and leading creative businesses. This will prepare students to deal effectively with changing market and client needs as they become more sophisticated and knowledgeable. Entrepreneurship has a significant impact on the country's economic growth and development. The dynamic of the corporate world is shifting in tandem with the global economy. The goal of this course is to instil and ignite an entrepreneurial spirit in pupils.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Identify and understand various constituents and environmental factors for innovation and entrepreneurship development.

CO2: Apply SWOT analysis for internal and external environmental assessment for devising a creative strategy for feasible business plans, within ethical boundaries.

CO3: Analyze feasibility of businesses under the constantly changing global environment for sustainable global competitiveness.

CO4: Evaluate the alternatives in order to be able to create successful business plans.

Detailed Syllabus:

UNIT-I

Entrepreneurship: India's startup evolution, Concept, trends, benefits; Rural entrepreneurship, social entrepreneurship, women entrepreneurship; role of entrepreneurship in economic development; Entrepreneur: - characteristics, Entrepreneurial decision process, functions, need for an entrepreneur, types of entrepreneurs.

UNIT-II

Starting the venture: generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study – market feasibility, technical/operational feasibility, financial feasibility: drawing business plan; preparing project report; Business plan- How to develop it, what all should it have, what it shouldn't have presenting business plan to investors

UNIT-III

Need for finance, sources of finance, Venture capital, Nature and Overview, Venture capital process, locating venture capitalists; Functional Plans: Marketing Plan- Market Segmentation, Market sizing, pricing strategy; Organizational Plan- form of ownership, designing organization structure, job design, manpower planning and Financial Plan.

UNIT-IV

Project Planning & Project appraisal; legal issues – intellectual property rights patents, trademarks, copyrights, trade secrets, licensing and franchising; Team Formation, Team Work Planning; Role of Government in Promoting Entrepreneurship; Entrepreneurial environment: factors affecting entrepreneurship growth, entrepreneurial motivation; Digital haves and Have-nots, Digital economy as a resource.

Suggested Readings:

1. Holt, David H. Entrepreneurship: New venture creation. prentice hall, 1992.

2. Entrepreneurship in Action, PHI B.K. Mohanty, Sangram Publication, 2005
3. Jayshree Suresh, Entrepreneurial Development, Margham Publications, 2015
4. Poornima M Charantimath, Entrepreneurship Development Small Business Enterprises, Pearson Education, 2006.
5. Mohanty, Sangram Keshari. Fundamentals of entrepreneurship. PHI Learning Pvt. Ltd., 2005.

Mapping Matrix of Course: 244MBCC1

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBCC1: Entrepreneurship and Innovation

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	2	2	2	3	2	2	2	2
CO2	3	3	3	3	3	3	3	2	2	3
CO3	2	2	2	3	3	2	3	2	3	2
CO4	2	2	2	2	2	2	2	3	2	2
Average	2.5	2.25	2.25	2.5	2.5	2.5	2.5	2.25	2.25	2.25

241/MBABA/CC402

**Big Data Analytics
244MBCC2**

Credit: 4

**External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.**

Type of Course: Core Course

Course Objectives: This module forms an introduction as well an in-depth study in the field of Big Data and Hadoop. It comprises the fundamentals as well as advanced topics needed to progress in this technology. The students will learn about the applications, usage and several use case scenarios pertaining to Big Data- Hadoop where they can use the knowledge and progress ahead. This course will help students gain knowledge and understanding about Big Data Technology, Hadoop Ecosystem and various tools related to it. The students will learn about the HDFS File System, Map Reduce Framework, Analyzing data using Hbase and Hive along with the Integration of R with Hadoop.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Memorize and understand the fundamentals of Big Data and its Applications in various Domains.

CO2: Apply and incorporate the technologies behind Big Data in business context.

CO3: Analyze the data using the architectures related to HDFS File Structure and Map Reduce Framework.

CO4: Evaluate and design programs for data processing for solving complex business problems.

Detailed syllabus:

Unit-I

What Is Big Data? History of Data Management, Evolution of Big Data, Structuring of Big Data, Elements of Big Data, Application of Big Data in the Business Context, Careers in Big Data. Business Applications of Big Data: The Significance of Social Network Data, Financial Fraud and Big Data, Fraud Detection in Insurance, Use of Big Data in the Retail Industry. Distributed and Parallel Computing for Big Data, Understanding Hadoop, Cloud Computing, Grid Computing and In-Memory Technology for Big Data. VMWare Installation of Hadoop, Linux and its Shell Commands, Different Hadoop Distributions and their advantages, Hortonworks, Cloudera, MapR.

Unit-II

The Hadoop Ecosystem, Storing Data with HDFS, Design of HDFS, HDFS Concepts, Command Line Interface to HDFS, Hadoop File Systems, Java Interface to Hadoop, Anatomy of a file read, Anatomy of a file write, Replica placement and Coherency Model. Parallel Copying with distcp, keeping an HDFS Cluster Balanced.

Unit-III

Origins of Map Reduce, How Map Reduce Works, Optimization Techniques for Map Reduce Jobs, Applications of Map Reduce, Java Map Reduce classes (new API), Data flow, combiner functions, running a distributed Map Reduce Job. Configuration API, setting up the development environment, Managing Configuration.

Unit-IV

Understanding R-Hadoop, Integration Procedure, Packages needed for R under Hadoop Ecosystem, Text Mining for Deriving Useful Information using R within Hadoop, Introduction to Hive & Hbase, Hive and Hbase Architecture, Understanding Queries, Mining Big Data with Hive & Hbase.

Suggested Readings:

1. Arshdeep Bahga, 2016, Big Data Science & Analytics: A Hands-On Approach.
2. Tom White, 2012, Hadoop: The Definitive Guide, O'Reilly.
3. Adam Shook and Donald Miner, 2012, Map Reduce Design Patterns: Building Effective
4. Algorithms and Analytics for Hadoop and Other Systems, O'Reilly.
5. Dean Wampler, Edward Capriolo & Jason Rutherglen, 2012, Programming Hive, O'Reilly.
6. Lars George, 2011, HBase - The Definitive Guide: Random Access to Your Planet- Size Data, O'Reilly.

Mapping Matrix of Course: 244MBCC2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBCC2: Big Data Analytics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2

Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2
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241/MBABA/DS401

SaS and Tableau

244MBDSE1

Credit: 3

External Marks: 50

Internal Marks: 25

Time Allowed: 3 Hrs

Type of Course: Discipline Specific Elective Course

Course Objective: This course forms an introduction as well as an in-depth study in the discipline of SaS programming with regards to Statistical Analysis along with Data Visualization through Tableau. This course will provide students and exposure towards SaS, Tableau and its usability in the field of analytics. The course comprises an introduction to SaS, its procedures, visualizations along with Tableau application usage and visualization basics.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Understand SaS in a virtual environment and basics of Tableau Interface.

CO2: Apply the tools of SaS to prepare and manipulate datasets for analysis in SaS.

CO3: Analyze the data for exploratory analysis within SaS environment using various procedures.

CO4: Evaluate the effectiveness of SaS, Tableau Interface, Panes and Visualization Techniques.

Detailed Syllabus:

Unit-I

Overview of SaS university edition, Deploying SaS Studio on virtual platform, File Management, SaS libraries, importing data, Structure of Data and Data Types, Program Syntax, saving data, PROC IMPORT and PROC CONTENTS, Displaying Data and Generating Logs, List Input. Variables and Syntax Rules, Data Set Options, Operators, In-File Statement, Input Styles, Select Statements, Leave and Continue, Decision Making via SaS, Where Statement, Looping Constructs, SaS Functions, Arrays and Array Processing, Modifying and Combining Data Sets.

Unit-II

Proc Data, Proc Sort, Proc Means Sort, Proc Means, Proc Univariate, Proc Freq, Proc Plot, Proc Sgplot, Proc Summary, Proc Contents, Proc Append, Proc Copy, Proc SQL, Proc Delete, Proc Format, Proc Import, Proc Export, Proc Transpose, Proc GChart, Proc GPlot, Proc Report.

Unit-III

Tableau Software Ecosystem, Toolbar Icons, Data Window and Aggregation, Tableau Data Source, Data Extract, Connect to Data, Measure Names, Number of Records & Measures, Heat Maps, Tree maps, Bar

Chart, Line Chart, Area Fill Charts, Pie Chart, Scatter Plot, Circle View, Bullet Graph, Packed Bubble, Histogram, Boxplot and Gantt Chart, Sorting Data, Enhancing Views with Filters, Sets, Groups & Hierarchies.

Unit-IV

Cross-tabulation, Dashboard Designing, Dashboard Actions, Joining Database, Functions in Tableau, Aggregate Functions, Numeric Functions, Date Functions, Stories, Advanced Mapping, Advanced Parameters, Tableau Best Practices, Combining Multiple Dashboards into Stories, Publishing Stories and Dashboards.

Suggested Readings:

1. Ron Cody, 2018, An Introduction to SaS University Edition, SaS Institute.
2. Ron Cody, 2018, Learning SaS by Example, SaS Institute.
3. Deepti Gupta. 2018, Applied Analytics through Case Studies Using SaS, Apress.
4. Joshua N. Milligan, 2015, Learning Tableau, Packt.
5. Ben Jones, 2014, Communication Data with Tableau: Designing, Developing and Delivering Data Visualization, O'Reilly.

Mapping Matrix of Course: 244MBDSE1

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBDSE1: SaS and Tableau

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

241/MBABA/DS402 Machine Learning & Artificial Intelligence

244MBDSE2

Credit:3

**External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs**

Type of Course: Discipline Specific Elective Course

Course Objective: This module comprises of conceptual, statistical and Machine Learning algorithms. It covers all the necessary models pertaining to Machine Learning such as Regression, Decision Trees, Support Vectors, Clustering, Association Analysis and Dimensionality Reduction. After this course students will gain critical knowledge and understanding about major Data Mining procedures like Decision Tree, Cluster Analysis, Neural Networks, Support Vector Machine, Bayesian Networks and Machine Learning fundamentals. Students will be able to apply and practice this gained knowledge in variety of Business Scenarios.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Understand the fundamentals of machine learning and artificial Intelligence.

CO2: Apply the machine learning algorithms for solving critical problem solving.

CO3: Analyze the efficacy of various machine learning algorithms.

CO4: Evaluate Machine Learning techniques and the Programming Framework to obtain acceptable decisions for the Real-World problems

Detailed syllabus

Unit - I

Classification & Regression, working of a Decision Tree, Attribute Selection Measures, Information Gain, Gain Ratio, Gini Index, Building Decision Trees, CART, C5.0, and CHAID Trees, Prediction by Decision Tree, Advantages and Disadvantages of Decision Trees, Model Overfitting, Building Decision Trees in R.

Unit - II

Cluster Analysis versus Factor Analysis, Overview of Basic Clustering Methods, Agglomerative Hierarchical Clustering, Within-Group Linkage, Nearest Neighbour or Single, Linkage, Furthest Neighbour or Complete Linkage, Centroid Clustering, Ward's Method, K- Means Algorithm, Dendrogram, Profiling of Cluster, Cluster Evaluation. Decision Boundaries for Support Vector Machine, Maximum Margin Hyperplanes, Structural Risk Minimization, Linear SVM-Separable Case, Linear SVM-Non-Separable Case, Kernel Function, Kernel Trick, Kernel Hilbert Space, Model Evaluation.

Unit - III

Market Basket Analysis and Association Analysis, Market Basket Data, Stores, Customers, Orders, Items, Order Characteristics, Product Popularity, Tracking Marketing Interventions, Association Rules, Support, Confidence, Lift, Chi-Square Value, Sequential Pattern Analysis.

Unit - IV

Current Trends in AI, Intelligent Agents, Environments, Problem Solving Agents, Searching Techniques, Knowledge and Reasoning in AI, Forms of Learning, Structure of a Neural Network, Analogy with Biological Neural Network, Activation Functions, Gradient Descent, Model Accuracy.

Suggested Readings:

1. Kevin Knight, Elaine Rich, B.Nair, 2017, Artificial Intelligence, McGraw.
2. Han, Jiawei and Kamber, Micheline, 2012, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers.
3. AnandRajaraman, 2011, Mining of Massive Datasets, Cambridge University Press.
4. Mitchell, 2013, Machine Learning, McGraw Hill.
5. Stuart Russell, Peter Norvig, 2004, Artificial Intelligence – A Modern Approach, Pearson.

Mapping Matrix of Course: 244MBDSE2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBDSE2: Machine Learning & Artificial Intelligence

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

Credit:3**External Marks: 50**
Internal Marks: 25
Time Allowed: 3 Hrs**Type of Course:** Specialization Specific Elective Course

Course Objective: This course aims to provide an exposure to students based on Natural Language Processing Techniques, Algorithms and Analytics based on Textual Data. The module comprises of NLP basics, Feature Extraction, Relationship Extraction, Text Categorization, Clustering and Topic Modelling Algorithms and Practices.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Understand approaches to Syntax and Semantics in NLP.

CO2: Apply the gained theoretical knowledge to extract information from Textual Unstructured Data.

CO3: Analyze the efficacy of various approaches of Natural Language Processing.

CO4: Evaluate topic Modelling and Probabilistic Models for Information Extraction.

Detailed Syllabus:**Unit-I**

Basics of Text Mining, Natural Language Content Analysis, Core Text Mining Operations, Associations, Using Background Knowledge for Text Mining, Domain Ontologies, Domain Lexicons. Text Mining Pre-processing Techniques, Task Oriented Approaches, NLP Tasks, Tokenization, Partof-Speech Tagging, Syntactical Parsing and Shallow Parsing. Finding Implicit Features, Finding Opinion Phrases and their Polarity, Context-Specific Word Semantic Orientation, Analysis of Word and Document Frequency, tf-idf, Zipf's Law, bind tf_idf Function, Subsequence Kernels for Relation Extraction, Capturing Relation Patterns with a String Kernel.

Unit-II

Applications of Text Categorization, Document Representation, Knowledge Engineering Approach to Text Categorization, Machine Learning Approach to Text Categorization, Evaluation of Text Classifiers. Clustering Tasks in Text Analysis, Clustering Algorithms and Clustering of Textual Data.

Unit-III

Tokenizing by N-gram, Counting and Filtering N-gram, Analysing Bigrams to provide Context in Sentiment Analysis, visualizing a Network of Bigrams using ggraph, Counting and Correlating Pairs of Words with the widyr Package, Counting and Correlating among Sections, Examining Pairwise Correlation.

Unit-IV

Latent Dirichlet Allocation, Word Topic Probabilities, Per-Document Classification, By-words Assignments, Alternative LDA Implementations. Hidden Markov models, Stochastic Context Free Grammar, Conditional Random fields, Parallel Learning Algorithms.

Suggested Readings:

1. Julia Silge, David Robinson, 2018, Text Mining with R-A Tidy Approach, O'Reilly
2. Matthew L. Jockers, 2014, Text Analysis with R for Students of Literature, Springer.
3. James Pustejovsky, Amber Stubbs, 2012, Natural Language Annotation for Machine Learning,

O'Reilly.

4. Steve R. Poteet, 2007, Natural Language Processing with Text Mining, Springer.

5. James Sanger, Ronen Feldman, 2002, The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data, Cambridge.

Mapping Matrix of Course: 244MBBA1

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA1: Natural Language Processing

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

241/MBABA/SS402

Python Programming

244MBBA2

Credit:3

External Marks: 50

Internal Marks: 25

Time Allowed: 3 Hrs

Type of Course: Specialization Specific Elective Course

Course Objectives: Python Programming module is intended for students who wish to learn the Python programming language. The module comprises of Programming basics with regards to Python Language such as Data Types, Operators, Functions, Classes and Exception Handling. This module will help students gain much needed knowledge pertaining to Python Programming, so as to prepare them for the advanced modules such as ML. Python scripting is user-friendly and is the most used language in industry when it comes to designing and scripting applications with respect to Emerging Technologies.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Memorize and develop conceptual understanding of Python.

CO2: Apply the conceptual knowledge of lists, tuples, and dictionaries to develop python programs.

CO3: Analyze the relevance of application Python for data analysis and solving complex business problems.

CO4: Evaluate and design programs for data processing for providing solutions to complex business problems.

Detailed Syllabus:

Unit-I

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input- Output, Indentation. Types -

Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions.

Unit-II

Lists, Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, Comprehensions, Conditional blocks using If, Else and El-if, For Loop, For loop using Ranges, String, list and Dictionaries, While Loop, Loop Manipulation using Pass, Continue, Break and Else, Conditional and Loops Block.

Unit-III

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Function Returning Values, Scope of the Variables in a Function - Global and Local Variables. Creating modules, Name Spacing, Introduction to PIP, Installing Packages via PIP, Using Python Packages. **Unit-IV**

Classes, Self-Variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding, Difference between an Error and Exception, Handling Exception, Try Except Block, Raising Exceptions, and User Defined Exceptions.

Suggested Readings:

1. R.Nageswara Rao, 2018, Core Python Programming, Dreamtech.
2. John Hearty, 2016, Advanced Machine Learning with Python, Packt.
3. Jake VanderPlas, 2016, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly.
4. Mark Lutz, 2010, Programming Python, O'Reilly.
5. Tim Hall and J-P Stacey, 2009, Python 3 for Absolute Beginners, Apress..

Mapping Matrix of Course: 244MBBA2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA2: Python Programming

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

241/MBABA/SS403

Cloud Computing

244MBBA3

Credit:3

External Marks: 50

Internal Marks: 25

Time Allowed: 3 Hrs

Type of Course: Specialization Specific Elective Course

Course Objectives: The objective of the course is to give students a comprehensive view understanding of the vision and impact of Cloud, cloud and IoT Market perspective and IoT and Cloud architecture.

Course Outcomes:

On the completion of this course the student will be able to:

CO1. Define and understand the concepts related to internet of things and cloud computing.

CO2: Apply cloud computing techniques for various applications for solving critical problems.

CO3: Analyse cloud computing services used at various levels.

CO4: Evaluate the efficacy of cloud computing techniques and designing cloud-based applications

Detailed Syllabus:

Unit - I

Overview of Cloud Computing: Brief history and evolution - history of cloud computing, evolution of cloud computing, traditional vs. cloud computing, cloud service models (IaaS, PaaS & SaaS), cloud deployment models (public, private, hybrid and community cloud), benefits and challenges of cloud computing, introduction to AWS public cloud vendor, cost optimization in AWS, basics of virtualization, virtualization technologies, server virtualization, VM migration techniques, role of virtualization in cloud computing, introduction to EC2 service of AWS.

Unit – II

Working with Private Cloud: Private cloud definition, characteristics of private cloud, private cloud deployment models, private cloud vendors - CloudStack, OpenStack, Eucalyptus Microsoft, private cloud ± benefits and challenges, private cloud implementation in Amazon EC2 service.

Unit – III

Working with Public Clouds: What is public cloud, why public cloud, when to opt for public cloud, public cloud service models, public cloud players, infrastructure as a service offering, IaaS vendors, PaaS offerings, PaaS vendors, software as a service, demonstrating public cloud with AWS ± storage and database services, private vs. public cloud ± when to choose.

Unit - IV

IoT Architecture- Introduction, State of the art: Architecture reference model introduction, reference model and architecture, IoT reference model. IoT Reference Architecture: IoT reference architecture- introduction, functional view, information view, deployment and operational view, other relevant architectural views, realworld design constraints- introduction, technical design constraints-hardware is popular again, data representation and visualization, interaction and remote control.

Suggested Readings:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Hwang Kai, Fox Geoffrey C, Dongarra Jack G, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2011.
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Mapping Matrix of Course: 244MBBA3

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA3: Cloud Computing

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2
