

**AMITY UNIVERSITY RAJASTHAN**

**Amity Directorate of Online Education**

**Master of Science (Data Science)**



**AMITY UNIVERSITY RAJASTHAN**

**Amity Directorate of Online Education**

**Master of Science (Data Science)**

**M.Sc. (D.S.)**

**Duration – 2 Years Online**

**Batch- 2024-26**

**Scheme and Syllabus**

# AMITY UNIVERSITY RAJASTHAN

Amity Directorate of Online Education

Master of Science (Data Science)

<b>Program Outcomes</b>		
<b>Master Of Science (Data Science)– M.Sc. (D.S.)</b>		
<b>S. No.</b>	<b>Description</b>	<b>POs</b>
<b>1.</b>	Develop in depth understanding of the key technologies in data science and business analytics, data mining, machine learning, visualization techniques, predictive modelling, and statistics.	<b>PO1</b>
<b>2</b>	Demonstrating practical and hands-on experience with programming languages and tools through lab exercise and project.	<b>PO2</b>
<b>3</b>	Apply data science concepts and methods to solve problems in real-world contexts and utilize effectively.	<b>PO3</b>
<b>4</b>	Utilize knowledge in a broad range of methods based on statistics and informatics to use them for data management, analysis and problem solving.	<b>PO4</b>

## **Program Education Objectives (PEOs):**

PEO 1: Develop a broad academic and practical literacy in computer science, statistics, and optimization, with relevance in data science.

PEO2: Enable students to understand not only how to apply certain methods, but when and why they are appropriate.

PEO 3: Integrate fields within computer science, optimization, and statistics to create adept and well-rounded data scientists.

PEO 4: To enable the learner to adapt and exhibit resilience towards change in technology

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

## PROGRAMME STRUCTURE M.Sc. (Data Science)

Semester	CC* Credits	DE * Credits	VA * Credits	NTCC	Total
I	4*5	0	1*4	0	24
II	5*5	0	1*4	0	29
III	3*5	2*5	0	1*6	31
IV	0	0	0	1*25	25
Total	60	10	08	31	109

SEMESTER-I				
S. No.	Course Code	Course Name	Course Type	Credit
1	MDS101	Probability and Statical Structures	Core Course	5
2	MDS102	Programming with Python	Core Course/ Employability	5
3	MDS103	Data Science -I	Core / Skill	5
4	MDS104	Data Warehousing and Mining	Core / Entrepreneurship	5
5	BC108	Professional communication	Value Added Course	4
SEMESTER-II				
S. No.	Course Code	Course Name	Course Type	Credit
1	MDS201	Linear Algebra and Matrices	Core course	5
2	MDS202	Data Science-II with R	Core / Skill	5
3	MDS203	Data Engineering	Core/ Skill	5
4	MDS231	Business Analytics	Core	5
5	MDS234	Data Visualization	Core	5
6	BS605	Cognitive Analytics and Social Skills for Professional	Value Added Course	4
SEMESTER-III				
S. No.	Course Code	Course Name	Course Type	Credit
1	MDS301	Optimization Techniques	Core	5
2	MDS302	Machine Learning and Deep Learning	Core/ Employability	5
3	MDS303	Natural Language Processing	Core/ Skill	5
4	MBA386	Big Data Analytics	Domain Elective (Select any 2)	5
5	MDS333	Artificial Intelligence		
6	MDS331	Data Science Product Development		
7	MDS334	Big Data & Analytics using R		

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

8	MCS350	Minor Project	Non-Teaching Credit Course	6
SEMESTER-IV				
<b>S. No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Credit</b>
1	MDS461	Internship	Non-Teaching Credit Course	25
Total Credit ( I+II+III+IV)				113

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### PROBABILITY AND STATISTICAL STRUCTURES

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS101	5	30	70	100

#### Course Objective:

The aim of the course is to introduce the probability and statistics of theoretical computer science and the theory of statistical analysis. Fundamental concepts in statistical analysis with emphasis on their applications to computer science will be taught.

#### Course Contents:

##### Module -I:

Probability: Sample space and events – Probability – The axioms of probability – addition law of probability – Conditional probability – Baye's theorem.

##### Module -II:

Random variables: Discrete and continuous – Distribution – Distribution function.  
Distribution - Binomial, poisson and normal distribution – related properties.

##### Module -III:

Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) proportions, sums, and differences. Test of Hypothesis – Means and proportions – Hypothesis concerning one and two means – Type I and Type II errors. One tail, two-tail tests.

##### Module-IV:

Tests of significance: Test of significance for attributes: Test for number of successes, Test for proportion of successes & Test for difference between proportions.

##### Module-V:

Student's t-test: Test the significance of mean, difference between means of two samples (Independent & dependent sample), chi-square test and goodness of fit, ANOVA test.

#### TEXT BOOKS:

1. Probability and statistics for engineers: Erwin Miller And John E.Freund. Prentice-Hall of India / Pearson , Sixth edition.
2. Statistical Method: S.P. Gupta, S. Chand, New Delhi, 46<sup>th</sup> Edition, 2021.

#### REFERENCE BOOKS:

1. Probability, Statistics and Random Processes Dr.K.Murugesan&P.Gurusamy by Anuradha Agencies, Deepti Publications.
2. Advanced Engineering Mathematics (Eighth edition), Erwin Kreyszig, John Wiley and Sons (ASIA) Pvt. Ltd., 2001.
3. Probability and Statistics for Engineers: G.S.S.BhishmaRao,sitech., Second edition 2005.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

## PROGRAMMING WITH PYTHON

Course Code	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS102	5	30	70	100

### Course Objective:

This course introduces core programming basics—including data types, control structures, algorithm development, and program design with functions—via the Python programming language. The course discusses the fundamental principles of Object-Oriented Programming, as well as in-depth data and information processing techniques. Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications.

### Course Contents:

#### Module-I

Introduction to Python- features and basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; understanding error messages; Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation

#### Module-II

Strings and text files; manipulating files and directories; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file.

#### Module-III

String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers

#### Module-IV

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Recursive functions.

#### Module-V

Simple graphics and image processing: “turtle” module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing; Simple image manipulations with 'image' module - convert to bw, greyscale, blur, etc.

### Text & References:

**Textbook:** *Fundamentals of Python: First Programs* , Author: Kenneth Lambert , Publisher: Course Technology, Cengage Learning, 2012

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### DATA SCIENCE – I

Course Code	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS103	5	30	70	100

**Course Objective:** The course will help the students to understand the basics of data science and various related techniques which they can use to develop their data science applications for solving real world problems.

#### Course Contents

##### Module-I

Data science definition. Data science benefit our society, Data science relation to other domains, Data science application areas, Data science challenges, Various Data science tools and programming platforms for developing data science applications, Role of data scientist, Data science growing market.

##### Module-II

Various types of databases and datasets such as structured, unstructured, graph, etc., Data related challenges today. Multimedia data, social media data, biological data, sensor data, etc. Different dataset with different challenges.

##### Module-III

Introduction to R and its history. Advantages of R, Install R Programming Language & R Studio, Various data science packages (machine learning, string manipulation, data visualization) in R and their application area. Various domain-specific datasets available in R.

##### Module-IV

Companies Using the R Programming language, Commercial market of R programming, In-memory computation in R and its benefits, Parallel and distributed programming computation using R, Package inclusion and industry programming practices.

##### Module-V

Machine learning, Supervised and unsupervised machine learning, semi-supervised machine learning, reinforcement learning. Various sub branches of supervised (classification, regression) and unsupervised machine learning (clustering and dimensionality reduction), Training and testing data.

#### *Text and References:*

- Hadley Wickham, and Garrett Grolemund. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition. O'Rielley
- Brett Lantz. Machine Learning with R: Expert techniques for predictive modeling, 3rd Edition. Packt Publishing.
- Peter Bruce, Andrew Bruce. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (2020). O'Rielley Publishing.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### DATA WAREHOUSING AND MINING

Course Code	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS104	5	30	70	100

#### Course Objective:

Both data warehousing and data mining are advanced recent developments in database technology which aim to address the problem of extracting information from the overwhelmingly large amounts of data which modern societies are capable of amassing. Data warehousing focuses on supporting the analysis of data in a multidimensional way. Data mining focuses on inducing compressed representations of data in the form of descriptive and predictive models. The course gives an in-depth knowledge of both the concepts.

#### Course Contents:

##### Module I: Data Warehousing

Introduction to Data Warehouse, its competitive advantage, Data warehouse vs Operational Data, Things to consider while building Data Warehouse

##### Module II: Implementation

Building Data warehousing team, Defining data warehousing project, data warehousing project management, Project estimation for data warehousing, Data warehousing project implementation

##### Module III: Techniques & Data Mining

Bitmapped indexes, Star queries, Parallel Processing, Partition views. From Data ware housing to Data Mining, Objectives of Data Mining, the Business context for Data mining, Process improvement, marketing.

##### Module IV: Data Mining and CRM

Customer Relationship Management (CRM), the Technical context for Data Mining, machine learning, decision support and computer technology.

##### Module V: Data Mining Techniques and Algorithms

Process of data mining, Algorithms, Data base segmentation or clustering, predictive Modeling, , Data Mining Techniques, Automatic Cluster Detection, Decision trees and Neural Networks.

#### Text & References:

##### Text:

- Data Warehousing, Data Mining & OLAP, Alex Berson, Stephen J. Smith, Tata McGraw-Hill Edition 2004.



# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

- Data Mining: Concepts and Techniques, J. Han, M. Kamber, Academic Press, Morgan Kaufman Publishers, 2001
- Data Ware housing: Concepts, Techniques, Products and Applications, C.S.R. Prabhu, Prentice Hall of India, 2001.

#### *References:*

- Mastering Data Mining: The Art and Science of Customer Relationship Management, Berry and Lin off, John Wiley and Sons, 2001.
- Data Mining”, Pieter Adrians, Dolf Zantinge, Addison Wesley, 2000.
- Data Mining with Microsoft SQL Server, Seidman, Prentice Hall of India, 2001.

## PROFESSIONAL COMMUNICATION

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
BC108	4	30	70	100

#### **Course Objective:**

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners’ communicative competence.

**Module I- Verbal and Nonverbal Communication:** Oral Communication: forms, advantages and disadvantages; Written Communication: forms, advantages and disadvantages; Principles and Significance of Nonverbal communication, KOPPACT(Kinesics, Oculesics, Proxemics, Paralinguistics, Artifactics, Chronemics, Tactilics

**Module II- Social Communication Essentials and Cross-Cultural Communication:** Small talk, building rapport, Informal Communication; Public speaking in multi-cultural context, Culture and Context, Ethnocentrism, stereotyping, cultural relativism, Cultural shock and social change

**Module III- Meetings:** Meaning and Importance, Purpose of Meeting, Steps in conducting meeting, Written documents related to meeting: Notice, Agenda, Minutes

**Module IV- Report Writing-** Types of report, Significance of Reports, Report Planning, Process of Report Writing, Visual Aids in Reports

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

**Module V -Employment Communication:** Cover Letter, Resume, participating in a Group Discussion, Preparing for interview, Appearing in an interview

#### **Text & References:**

##### *Text:*

- Essentials of Management, H. Koontz
- Principles and Practices of Management, Bakshi
- Student Study Material (SSM)

##### *References:*

- Management, Stoner, Freemond & Gilbert
- Principles & Practices of Management, L.M. Prasad / C.B. Gupta
- Management Today, Burton & Thakur

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### LINEAR ALGEBRA AND MATRICES

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS201	5	30	70	100

#### Course Objective:

The students will be able to:

1. Solve the given system of linear equations through matrices.
2. Verify whether the given set is a vector space or not. If So, determine its dimension.
3. Determine the matrix for the given linear transformation.
4. Predict ortho normal basis
5. Compute Eigen values, Eigen vectors and model to a quadratic form; and construct a singular value decomposition for the given matrix
6. Perform diagonalization of a given matrix

**Prerequisite:** Nil

#### Module I

SYSTEM OF LINEAR EQUATIONS AND MATRICES: System of linear equations, Gauss – elimination, Elementary matrices, and a method for finding inverse of a matrix.

#### Module II

VECTOR SPACES: Vector spaces and subspaces – Linear combination, Span, Linear independence and dependence, direct sum, basis, and dimension of a vector space,

#### Module III

LINEAR TRANSFORMATION: Introduction to linear transformations – General Linear Transformations – Kernel and range, Rank, and nullity. Matrices of general linear transformation

#### Module IV

EIGEN VALUES AND EIGEN VECTORS: Introduction to Eigen values & Eigen Vector, Diagonalizing a matrix- Orthogonal diagonalization, matrices- Similar matrices.

#### Module V

INNER PRODUCT SPACES: Inner product, Length, angle, and orthogonality – Orthogonal sets, Inner product spaces – Orthonormal basis: Gram-Schmidt process.

#### Reference Books

1. Howard Anton and Chris Rorres, “Elementary Linear Algebra”, Wiley, 2011.
2. David C. Lay, “Linear Algebra and its Applications”, Pearson Education, 2011.
3. Gilbert Strang, “Linear Algebra and its Applications”, Thomson Learning, 2009.
4. Steven J. Leon, “Linear Algebra with Applications”, Prentice Hall, 2006.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### DATA SCIENCE – II WITH R

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS202	5	30	70	100

**Course Objective:** The course will help the students to understand the data science and various related techniques which they can use to develop their data science applications for solving real world problems.

#### Course Contents

##### Module-I

Analyze data, mean, mode, data types, basic data analysis functions such as str, nrow, ncol, mean, mode, class, etc., Parametric, and non-parametric data, Advantages of Parametric Tests, ANOVA, T-Test, F-test, Z-test, Wilcox-Test, Importance of them, Import and export of various types of data files in R. How to read web data and social media data. Basic data plotting.

##### Module-II

Missing values and their effects on data, Outliers and their effects on data, Importance of identifying missing values and outliers. Classical methods to identify missing values and outliers. Conditions to replace missing values and outliers, Conditions to delete missing values and outliers.

##### Module-III

Linear regression, multiple linear regression, non-linear regression, When to do linear and non-linear regression, Performance evaluation of regression results. Logistic regression, Analyze the prediction results using various statistics of confusion matrix such as accuracy, sensitivity, specificity, etc. Visualize confusion regression results.

##### Module-IV

Supervised learning: Classification and regression using Support Vector Machine, Random Forest, Neural Networks, Naive Bayes, and Decision Tress supervised machine learning algorithms. Performance evaluation and parameter tuning to improve results.

##### Module-V

Unsupervised Learning: K-Means Clustering, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Expectation–Maximization (EM) Clustering etc. Principal component Analysis. Determination of the number of clusters. Performance evaluation metrics such as Root-mean-square standard deviation (RMSSTD) of the new cluster, R-squared (RS), Dunn’s Index (DI).

#### Text and References:

- Hadley Wickham, and Garrett Grolemond. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition. O'Rielley
- Brett Lantz. Machine Learning with R: Expert techniques for predictive modeling, 3rd Edition. Packt Publishing.
- Peter Bruce, Andrew Bruce. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (2020). O'Rielley Publishing.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### DATA ENGINEERING

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS203	5	30	70	100

**Course Objective:** The course will help the students to understand the data, its properties and various related behaviors which they can use to develop their data science applications for solving real world problems.

#### Course Contents

##### Module-I

Concepts, processes, and tools for data engineering. To understand the modern data ecosystem. Role of data engineers. Different properties and behaviors of data and its importance. Role of good quality data in machine learning model.

##### Module-II

Anomalies or outliers, Reasons that outliers may reduce machine learning model performance, Conditions to delete outlier observation and when to predict it, Two real-world cases studies to show why it is important to detect outliers?

##### Module-III

Missing values, Reason why they can reduce performance of machine learning model, Conditions when to delete missing observation and when to impute it, Two real-world cases studies to show importance to detecting missing values and to delete or impute them

##### Module-IV

Concept of dimensionality reduction. On what basis we select feature that needed to be removed. Reducing dimension somewhat solve big data problem. Dimensionality reduction may improve accuracy of a machine learning model.

##### Module-V

Feature extraction and its importance. Various tools and platforms for feature selection, extration and visualization.

#### *Text and References:*

- Rajesh Kumar Shukla et al. Data, Engineering and Applications: Volume 1. Springer; 1st ed. 2019 edition (7 May 2019)
- Rajesh Kumar Shukla et al. Data, Engineering and Applications: Volume 2. Springer; 1st ed. 2019 edition (7 May 2019)
- Brian Shive. Data Engineering: A Novel Approach to Data Design

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### BUSINESS ANALYTICS

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS231	5	30	70	100

#### Course Objective:

This course introduces Business Intelligence, including the processes, methodologies, infrastructure, and current practices used to transform business data into useful information and support business decision-making. Business Intelligence requires foundation knowledge in data storage and retrieval; thus this course will review logical data models for both database management systems and data warehouses.

#### Course Contents:

##### Module I: Introduction to Business Intelligence

Introduction to digital data and its types- structured, semi-structured and unstructured, Introduction to OLTP and OLAP, BI Definitions and Concepts, BI Framework.

##### Module II: Data Warehousing concepts

Data Warehousing concepts and its role in BI, BI Infrastructure Components- BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

##### Module III: Basics of Data Integration (Extraction Transformation Loading)

Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Introduction to data quality, data profiling concepts and application.

##### Module IV: Data Introduction to Multi-Dimensional Data Modeling

Introduction to data and dimension modeling, multidimensional data model, ER Modeling VS multi-dimensional modeling, concepts of dimension, facts, cubes, attribute, hierarchies, star and snowflake schemas, introduction to business metrics and KPIs.

##### Module V: Basics of Enterprise Reporting

A typical enterprise, Malcom Baldrige- quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard VS enterprise dashboard, enterprise reporting using MS Excel.

#### Text & References:

- Fundamentals of Business Analytics – R. N. Prasad & Seema Acharya, Business Intelligence (2nd Edition), Efraim Turban, Ramesh Sharda, Dursun Delen, David King
- Delivering Business Intelligence with Microsoft SQL Server 2012, Brian Larson

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### DATA VISUALIZATION

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS234	5	30	70	100

#### Course Objective:

This course is designed to provide students with the foundations necessary for understanding and extending the current state of the art in data visualization. By the end of the course, students will have gained: An understanding of the key techniques and theory used in visualization, including data models, graphical perception and techniques for visual encoding and interaction. Exposure to a number of common data domains and corresponding analysis tasks, including working on Python, R and Tableau.

#### Course Contents:

##### Module I: Data preparation and manipulation

Python and Jupyter notebook overview, Introduction to numpy; create arrays with numpy and Python; operations on multiple arrays and scalars; universal array functions in numpy; transpose arrays with numpy; import and export arrays. Introduction to Pandas – series, data frames, index Series and data frames in pandas, re-index, drop entry, data alignment, rank and sort data entries, summary statistics in pandas, dealing with missing data; reading and writing files.

Merge, concatenate and combining data frames, reshaping, pivoting, handling duplicates in data frame, mapping with pandas, replace, rename indexes in pandas, using bins, find outliers in your data with pandas, group by on data frames, group by on dictionary and series, aggregation, split-apply-combine technique, cross-tabulation in pandas

##### Module-II: Data Visualization in Python

Installing seaborn; create histograms using seaborn, KDE plots, combining plot styles, combine histograms, and rug plots, box and violin plots, regression plots, heat maps with seaborn.

##### Module-III: Data Visualization in R

introduction to R; ggplot2 foundations- geometries, facets, statistics, export plot; data wrangling- data transformation, grouping, piping, pivoting, transform and visualize data; exploratory data analysis- histogram and density plot, frequency polygon, area plot, bar plot; scatter plot, rug plot, bivariate distribution, boxplot, violin plot, matrix plots;

##### Module-IV: Advanced Data Visualization in R

Size and shape of points- facet wrap, facet grid, rmarkdown; pie chart, donut chart, time series visualization, waterfall chart, radar chart, parallel coordinates plot, heat map, mosaic plot; plot customization- themes, annotations and labels

##### Module-V: Visualization Techniques in Tableau

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

Domain padding and densification; data preparation using excel and custom SQL; viola chart; hexbin chart; advanced table calculations- addressing and partitioning; nested table calculations; sankey diagram- base sankey calculations, secondary calculations, nested table calculations; likert scale visualization - data preparation: lookups, cleaning, and pivoting, base likert calculations; dashboard layout techniques.

#### **Text & References:**

Fundamentals of Data Visualization Primer on Making Informative and Compelling Figures, Claus Wilke, O'Reilly Media, 2019, ISBN 9781492031055

Interactive Data Visualization Foundations, Techniques, and Applications, Second Edition, Matthew O. Ward, CRC Press, 2015, ISBN 9781482257380

Data Visualization A Practical Introduction, Kieran Healy, Princeton University Press, 2019, ISBN 9780691181622

### **Cognitive Analytics and Social Skills for Professional**

<b>COURSE CODE</b>	<b>CREDIT UNITS</b>	<b>CE Marks</b>	<b>ETE Marks</b>	<b>Total Marks</b>
<b>BS605</b>	<b>4</b>	<b>30</b>	<b>70</b>	<b>100</b>

#### Course Objectives & Learning Outcomes

##### Course Objectives:

- To understand the Cognitive Analytics and Social Cognition
- To apply emotional intelligence in decision making
- To develop leadership skills for effective management
- To practice resilience during uncertainty

##### Learning Outcomes:

Students will be able to:

- Demonstrate cognitive and social skills in problem solving.
- Apply emotional intelligence in decision making.
- Translate leadership skills in practice for effective management.
- Implement resilience during adversity.



# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### Syllabus

#### **Module 1- Cognitive Analytics and Social Cognition**

- Understanding the self-preliminaries
- Models of Understanding Self- T-E-A Model
- Models of Understanding Self-Johari Window
- Models of Understanding Self-PE Scale
- Meaning and Importance of Self Esteem, Self-Efficacy, Self-Respect
- Behavioural Communication- Assertive Skills
- Technology adoption, Social Media Etiquettes
- Creativity (ICEDIP Model), Visualization
- Problem sensitivity
- Problem Solving (Six Thinking Hats)
- Cognitive Flexibility
- Cognitive Errors
- Introduction to Social Cognition
- Attribution Processes (Perceptual Errors)
- Social Inference
- Stereotyping
- Prejudice
- Accepting Criticism

#### **Module 2 : Attitudes & Emotional Intelligence**

- Understanding Attitudes
- Characteristics of Attitude: valence
- Characteristics of Attitude: multiplicity
- Characteristics of Attitude: relation to needs
- Characteristics of Attitude: centrality, pervasiveness
- Characteristics of Attitude: invisible, acquired
- Components of Attitudes (Affective, Cognitive, Behavioural)
- What are Emotions
- Healthy and Unhealthy expression of emotions
- Relevance of EI at workplace
- Emotional Intelligence and Competence
- Components of Interpersonal Intelligence
- Intrapersonal Intelligence

#### **Module 3 : Leadership and Managing Excellence**

- Team Design Features
- Life Cycle of a Teams
- Types of Team Building
- Development of Team Building
- Issues in Team Performance
- Types of leaders
- Leadership styles in organizations: Part 1
- Leadership styles in organizations: Part 2
- Situational Leadership
- Strategic Leadership and Change Management- Mentoring, Building Trust, Building a Culture of Inclusion: Part 1
- Strategic Leadership and Change Management- Mentoring, Building Trust, Building a

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### Culture of Inclusion: Part 2

- Sociometry (Sociometry Criteria, Applications of Sociometry, Construction of sociogram): Part 1 (Repeated)
- Personal Branding
- Time Management
- Work Life Integration
- Relationship Management (Personal & Professional)

#### **Module 4 Conflict Resolution and Negotiation**

- Meaning, nature, sources, stages & types of conflicts
- Factors affecting conflict
- Impact of Conflict
- Ethical Dilemmas in Conflict
- Conflict Resolution Strategies
- Comparison of conflict management styles
- Matching conflict management approach with group conditions
- Third Party Intervention- Mediation, mediation process, function of the mediator, preconditions for mediation: Part 1
- Third Party Intervention- Mediation, mediation process, function of the mediator, preconditions for mediation: Part 2
- Intercultural communication and conflict resolution• Negotiation -Types, purpose, stages: Part 1
- Negotiation -Types, purpose, stages: Part 2
- Four pillars of negotiation
- Strategies, Persuasion
- Behaviour and conduct during negotiation
- Closing the negotiation

#### **Module 5 : Values & Ethics**

- Meaning & its type
- Difference between values and Ethics
- Relationship between Values and Ethics
- Significance of moral values
- Practical Applications of Values & Ethics
- Moral Icons
- Its role in personality development
- Character building-“New Self awareness”
- Personal values-Empathy, honesty
- Personal values- courage, commitment
- Core Values -Respect, Responsibility
- Core Values - Integrity, Care, & Harmony

#### **Resilience and Agility in Uncertainty**

- Overview of Resilience
- Paradox of choice
- Overcoming negative thinking- Abc technique (Adversity, believes and consequences)
- Personality & cognitive variables that promote resilience
- Role of family and social networks

# **AMITY UNIVERSITY RAJASTHAN**

## **Amity Directorate of Online Education**

### **Master of Science (Data Science)**

- Models, Symptoms and consequences of stress: Part 1
- Models, Symptoms and consequences of stress: Part 2
- Strategies for stress management: Part 1
- Strategies for stress management: Part 2
- Agility in VUCA environment
- Resilience and agility for higher performance

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

## OPTIMIZATION TECHNIQUES

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS301	5	30	70	100

#### Course Objective:

Students will learn the tools and techniques of quantitative analysis outlined in the schedule, how and when to apply them, and practice application of those tools. Students completing this goal will be prepared to quantify a variety of policy problems for analysis and decision making. The syllabus includes Linear, Non-linear Programming, and Transportation.

#### Course Contents:

##### Module I: Introduction of OR and Linear Programming

Basic Definition, Application and Scope of OR, General Methods for Solving or Models. General Structure of Linear Programming,

Linear Programming Solutions: Mathematical formulation of LPP, Standard form of LPP, Multiple Solution, Unbounded Solutions, Infeasible Solution of LPP.

##### Module II: Simplex Method & Duality in LPP

Maximization and Minimization Problem, Solution of LPP using Graphical method, Simplex Method, two Phase Method, Big M Method.

Dual Linear Programming Problem, Rules for Constructing the Dual from Primal, Feature of Duality.

##### Module III: Transportation Problem

Mathematical Model of Transportation Problem, Transportation Method, Northwest Corner Method, Linear Cost Method, Vogel's Approximation Method, Unbalanced Supply and Demand, Degeneracy Problem, Alternative Optimal Solution, Maximization Transportation Problem.

##### Module IV: Theory of Games

Two Person Zero-Sum Games, Pure Strategies, Game with Saddle Point, Games without Saddle Point, Rule of Dominance, Methods for Solving Problems without Saddle Point.

##### Module V: Queueing Models

Basic component of queueing theory, Birth and Death processes – Single and multiple server queueing models (M/M/1) – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

#### Text & References:

##### Text:

- Operations Research, J K Sharma, Macmillan Publication

##### References:

- Operations Research, H. A. Taha
- Operations Research, Kanti Swaroop, Macmillan Publication

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### MACHINE LEARNING AND DEEP LEARNING

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS302	5	30	70	100

**Course Objectives:** To be able to formulate machine learning problems corresponding to different applications. The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various deep learning methods in NLP, Neural Networks etc

#### **Module I: Regression, Classification and Clustering**

Machine learning theory - ML vs. DL vs. AI – data preprocessing; regression; supervised learning techniques and un-supervised learning techniques (clustering) ; evaluation of models' performance; model selection; over-fitting, bagging and boosting, dimensionality reduction and feature selection. Bias - variance trade-off.

#### **Module II: Deep Learning**

Introduction to deep learning - neural network - binary classification - logistic regression - gradient descent - logistic regression gradient descent - deep net - the vanishing gradient problem - training a neural network

#### **Module III: Model Tuning**

Forward propagation in a deep network - forward and backward propagation - sigmoid vs. softmax - choosing learning rate and regularization penalty – grid search- parameters vs hyper-parameters; building an ANN;

#### **Module IV – CNN**

Basics of CNN ; convolution operation – ReLU – Pooling – flattening- full connection- softmax and cross-entropy – building a CNN – Dimensionality Reduction- Principal Component Analysis - Linear Discriminant Analysis

#### **Module IV – RNN**

Basics of RNN; building a RNN - Vanishing Gradient Problem – Model Selection & Boosting - k-Fold Cross Validation - Grid Search - LSTMs

#### **Text Books and References:**

1. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.
2. Tom M. Mitchell, Machine Learning, Mc Graw Hill, 2017
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2010.
5. Simon O. Haykin, Neural Networks and Learning Machines, Pearson Education, 2016

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### NATURAL LANGUAGE PROCESSING

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS303	5	30	70	100

**Course Objective:** The course will help the students to understand the basics of natural language processing and various techniques which can be implemented to analyze NLP data.

#### Course Contents

##### Module-I

Natural Language Processing, its importance and its significance now, Natural Language Processing Workflow (Lexical Analysis, Parsing, Semantic Analysis, Discourse Integration, Pragmatic Analysis), Components of NLP, Natural Language Understanding (analyzing, mapping), Natural Language Generation (Text planning, Sentence planning, Text Realization), Challenge of ambiguity

##### Module-II

Different data sources of Natural Language Processing, Natural Language Processing tools and packages, social media data analysis (Twitter analysis), create Twitter Application development account, Various Twitter analysis package in R. Unwanted data in tweets, and social media posts. Understanding the psychology of the social media user.

##### Module-III

Sentiment analysis and behavioral analysis, NLP and Writing Systems, Implement NLP using machine learning and Statistic, Information retrieval & Web Search using NLP, Google, Yahoo, Bing, and other search engines base their machine translation technology on NLP machine learning models. Machine learning for reading text on a webpage, interpret its meaning and translate it to another language.

##### Module-IV

Document processing (word, pdf files, etc). Various R packages used for document processing. Reading and analyzing a document. Differentiating between various documents automatically with the help of machine learning. Visualizing the analyzed document results.

##### Module-V

Two real world Natural Language Processing case studies

#### *Text and References:*

- Julia Sigie. Text Mining with R: A Tidy Approach 1st Edition. O'Rielley Publications

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### BIG DATA ANALYTICS

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MBA386	5	30	70	100

**Course Objectives:** The main objective of this course is to study the basic technologies that forms the foundations of Big Data and the programming aspects of cloud computing with a view to rapid prototyping of complex applications. To understand the specialized aspects of big data including big data application, and big data analytics.

#### UNIT I

##### Introduction to Big Data

What Exactly Is Big Data? History of Data Management, Big Data Evolution, Big Data Structuring, Big Data Elements, Big Data Application in the Business Context, Big Data Careers. The Importance of Social Network Data, Financial Fraud and Big Data, Fraud Detection in Insurance, and the Use of Big Data in the Retail Industry.

#### UNIT II

##### Technologies for Handling Big Data

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 III

##### Understanding the Hadoop Ecosystem

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 IV

##### Map Reduce Fundamentals

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 V

##### Integrating R with Hadoop, Understanding Hive & Hbase

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.

#### References

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

1. Arshdeep Bahga, 2016, *Big Data Science & Analytics: A Hands-On Approach*, VPT.
2. Tom White, 2012, *Hadoop: The Definitive Guide*, O'Reilly.
3. Adam Shook and Donald Miner, 2012, *Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems*, O'Reilly.
4. Dean Wampler, Edward Capriolo & Jason Rutherglen, 2012, *Programming Hive*, O'Reilly.

## ARTIFICIAL INTELLIGENCE

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS333	5	30	70	100

### Course Objective:

The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. The emphasis of the course is on teaching the fundamentals and not on providing a mastery of specific commercially available software tools or programming environments. Upon successful completion of the course, you will understand the basic areas of artificial intelligence search, knowledge representation, learning and their applications in design and implementation of intelligent agents for a variety of tasks in analysis, design, and problem-solving.

### Course Contents:

#### Module I: Introduction

AI and its importance, AI Problem, Application area.

#### Module II: Problem Representations

State space representation, problem-reduction representation, production system, production system characteristics, and types of production system.

#### Module III: Heuristic Search Techniques

AI and search process, brute force search, depth-first search, breadth-first search, time and space complexities, heuristics search, hill climbing, best first search, A\*, AO\* algorithm, constraint satisfaction, and beam search.

#### Module IV: Knowledge Representation issues using predicate logic

Representation and mapping, knowledge representation mechanism, inheritable knowledge, Propositional logic: syntax and semantics, First Order Predicate Logic (FOPL).

#### Module V: Expert System

Basic understanding of Fuzzy Logic, Artificial Neural Network, Perceptron, Natural Language Processing, Pattern Recognition, Robotics, LISP and Prolog. The role of Artificial intelligence in Biotechnology. Introduction to Bio-inspired computing.

### Text & References:

#### Text:

- Artificial Intelligence – II Edition, Elaine Rich, Kevin Knight TMH.

#### References:

- Foundations of Artificial Intelligence and Expert Systems, V S Janakiraman, K Sarukesi, P Gopalakrishnan, Macmillan India Ltd.



# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

- Introduction to AI and Expert System, Dan W. Patterson, PHI.

## DATA SCIENCE PRODUCT DEVELOPMENT

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS331	5	30	70	100

**Course Objective:** The course will help the students to understand the data science, its properties and various related behaviors which they can use to develop their data science applications for solving real world problems.

### Course Contents

#### Module-I

Concepts of Data science products, their benefits, and challenges, Steps to build a data science product from planning, demand analysis, features to deployment. Identify the domain where data science product can benefit the society.

#### Module-II

Tools available for Data Science product development. R Shiny for data science product development. Static and dynamic data science products. Dashboards as a data science product. Build Shiny app, Standalone apps, Interactive documents, Dashboards, Gadgets, Backend, Reactivity, Frontend, User interface, Graphics & visualization, Shiny extensions, Customizing Shiny.

#### Module-III

No-code AI will make AI/ML accessible, Augmented Analytics to transform Business Intelligence, AI-powered Automation, Artificial Intelligence (AI) for Cybersecurity and Data Breach, Smart Cities, Smart healthcare, Smart retail, etc.

#### Module-IV

AI-powered chatbots, Conversational AI, or AI-powered chatbots, improves the reach, accessibility, and personalization of the consumer experience. Conversational AI solutions, according to Forrester, result in improved customer service automation.

#### Module-V

3 Real world case studies

### *Text and References:*

- Emmanuel Ameisen. Building Machine Learning Powered Applications: Going from Idea to Product 1st Edition. O'Rielley Publishing.
- Hadley Wickham, and Garrett Grolemund. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition. O'Rielley

# **AMITY UNIVERSITY RAJASTHAN**

## **Amity Directorate of Online Education**

### **Master of Science (Data Science)**

- Brett Lantz. Machine Learning with R: Expert techniques for predictive modeling, 3rd Edition. Packt Publishing.
- Peter Bruce, Andrew Bruce. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python (2020). O'Rielley Publishing.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### BIG DATA & ANALYTICS USING R

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS334	5	30	70	100

**Course Objective:** The course will help the students to understand the data, its properties and various related behaviors which they can use to develop their data science applications for solving real world problems.

#### Course Contents

##### Module-I

Introduction to Big Data & Big Data Challenges Preview, Limitations & Solutions of Big Data Architecture, Bigdata Concepts, Bigdata sources, climate data, multimedia data, social media data, youtube data, etc., and bigdata tools and platforms.

##### Module-II

Introduction to Hadoop, Apache, Pig, Hive, Flume, Sqoop, Zookeeper, Oozie, Spark, SAP HANA, Microsoft Azure, Cassandra, MongoDB, Google Big Query, Cloudera. Comparison between Hadoop, Spark, Cassandra, Mongo DB, etc., Parallel and distributive computing, their advantages and disadvantages, and differences.

##### Module-III

Big data strategies: Sample and Model, Chunk and Pull, Push Compute to Data. Hadoop and its elements, Hadoop distributed file system (HDFS) and its operations, HBase, Mapreduce ( Splitter, Mapper , Shuffle, Reducer), Pig, Hive, YARN, R and Hadoop Integrated Programming Environment (RHIPE), Open source package RHadoop.

##### Module-IV

Tricks to handle Bigdata in R, Minimize copies of data, Process data in chunks, Compute in parallel, Leverage integers, Use efficient file formats and data types, Load only data you need, Minimize loops, Memory cleanup, R object deletion after usage.

##### Module-V

3 Real world case studies

#### Examination Scheme:

Components	C T	Assignment	P/V	Quiz	Attd	EE
Weightage (%)	15	10	10	10	5	50

#### Text and References:

- Simon Walkowiak, Big Data Analytics with R, Packt Publishing. (2016)

# **AMITY UNIVERSITY RAJASTHAN**

## **Amity Directorate of Online Education**

### **Master of Science (Data Science)**

- Benjamin Bengfort and Jenny Kim., Data Analytics with Hadoop: An Introduction for Data Scientists 1st Edition. O'Reilley Publication.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### MINOR PROJECT

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS350	6	---	----	100

#### GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge, which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

#### In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

#### Report Layout

The report should contain the following components.

#### 1. File should be in the following specification

- A4 size paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top & bottom margins: 1 inch/ 2.5 cm
- Left & right margins: 1.25 inches/ 3 cm

#### 2. Report Layout: The report should contain the following components

Front Page

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

Table of Contents  
Acknowledgement  
Student Certificate  
Company Profile  
Introduction  
Chapters  
Appendices  
References / Bibliography

➤ **Title or Cover Page or Front Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

➤ **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

➤ **Acknowledgement**

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

➤ **Student Certificate**

Given by the Institute.

➤ **Company Certificate & Profile**

This is a certificate, which the company gives to the students. A Company Profile corresponds to a file with company-specific data. Company data can be stored there and included in a booking when needed.

➤ **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➤ **Chapters**

All chapters and sections must be appropriately numbered, titled and should neither be too long nor too short in length.

The first chapter should be introductory in nature and should outline the background of the project, the problem being solved, the importance, other related works and literature survey.

The other chapters would form the body of the report. The last chapter should be concluding in nature and should also discuss the future prospect of the project.

➤ **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### ➤ **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

#### **ASSESSMENT OF THE PROJECT FILE**

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following *assessment objectives*:

1. Writing a critical literature review
  - Search for literature
  - Summarizing and presenting the literature
  - Evaluating key content and theories
2. Collecting and analyzing research material
  - Choosing and designing research method
  - Conducting the research
  - Analyzing, sorting and classifying the data to make decision
3. Interpreting research method and draw conclusion
  - Findings
  - Recommendation
4. Assigning the theories and writing the project report
  - Structuring the project in accordance with the given style
5. Bibliography
  - This refer to the books, Journals and other documents consulting while working on the project

# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### PROJECT WORK

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS460	25	---	-----	100

#### GUIDELINES FOR PROJECT FILE

The end semester evaluation of the project work will be based on the report and a Viva-Voce Examination by a team consisting of the Faculty Guide and External Examiner(s) who are appointed depending on the chosen areas of specialization of the students. **The duration of fast track examination is 3 months and then student will allow to take 3 month project work as it will give students exposure for practical aspect and satisfactory completion of project work should be critiqued by the faculty guide and corrected by the student.**

#### In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
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Front Page

Table of Contents

Acknowledgement

Student Certificate

Company Profile

Introduction

Chapters

Appendices

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# AMITY UNIVERSITY RAJASTHAN

## Amity Directorate of Online Education

### Master of Science (Data Science)

#### INTERNSHIP

COURSE CODE	CREDIT UNITS	CE Marks	ETE Marks	Total Marks
MDS461	25			100

#### GUIDELINES FOR PROJECT FILE

The end semester evaluation of the internship will be based on the report and a Viva-Voce Examination by a team consisting of the guide and External Examiner(s) who are appointed depending on the chosen areas of specialization of the students. **The duration of fast track examination is 3 months and then student will allow to take 3 month internship as it will give students exposure to industry for practical scenario and satisfactory completion of internship taking into account that initial Report/Project file should be critiqued by the faculty guide and corrected by the student.**

#### In general, the File should be comprehensive and include

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Table of Contents

Acknowledgement

Student Certificate

Company Profile

Introduction

Chapters

Appendices

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