

**School of Computer Applications
Master of Computer Applications (Data Science & Artificial Intelligence)
In Collaboration with IBM**

Eligibility: BCA or Graduation with CS/ IT or equivalent courses, rest all criteria will be as per UGC and State Government Norms

Minimum Duration of the Course: 2 Years

Maximum Duration of the Course: 4 Years

School of Computer Applications
Master of Computer Applications (Data Science & Artificial Intelligence)
In Collaboration with IBM
Evaluation Scheme (w. e. f. Academic Session 2021-22)

SEMESTER I										
Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits	Mode
			L	T	P	CIA	ESE	Course Total		
Theory										
C	MCADS1101	Python with Data Science	3	1	0	40	60	100	4	IBM
C	MCADS1102	Introduction to Soft Computing	3	1	0	40	60	100	4	School
F	MCADS1103	Probability and Statistics	3	1	0	40	60	100	4	
C	MCA4104	Relational Database Management System	3	1	0	40	60	100	4	
C	MCADS1105	Advance JAVA	3	1	0	40	60	100	4	
Practical										
C	MCA4151	Relational Database Management System Lab	0	0	4	40	60	100	2	School
C	MCADS1152	Advance JAVA Lab	0	0	4	40	60	100	2	
	GP1101	General Proficiency	-	-	-	100	-	100	1	
Total			15	5	8	-		800	25	

SEMESTER II										
Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits	Mode
			L	T	P	CIA	ESE	Course Total		
Theory										
C	MCADS1201	Descriptive Analytics	3	1	0	40	60	100	4	IBM
	MCADS1202	NoSQL and MONGO DB	3	1	0	40	60	100	2	
C	MCADS1203	Big Data and Data Warehousing	3	1	0	40	60	100	4	School
C	MCADS1204	Data Privacy Fundamentals	3	1	0	40	60	100	4	
C	MCADS1205	Web Technology & Application Development Using Python	3	1	0	40	60	100	4	
C	MCADS1206	Advance .Net Framework and C#	3	1	0	40	60	100	4	
Practical										
C	MCADS1251	Web Technology & Application Development Using Python Lab	0	0	4	40	60	100	2	School
C	MCADS1252	Advance .Net Framework and C# Lab	0	0	4	40	60	100	2	
	GP1201	General Proficiency	-	-	-	100	-	100	1	
Total			18	6	8	-		900	27	

SEMESTER III										
Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits	Mode
			L	T	P	CIA	ESE	Course Total		
Theory										
C	MCADS1301	Big Data Analytics and Architecture	3	1	0	40	60	100	4	IBM
	MCADS1302	Artificial Intelligence	3	1	0	40	60	100	4	
C	MCADS1303	Client Side Scripting	3	1	0	40	60	100	4	School
SE	-	Specialization Elective I	3	1	0	40	60	100	4	
SE	-	Specialization Elective II	3	1	0	40	60	100	4	
GE	-	Generic Elective	3	1	0	40	60	100	4	
Practical										
C	MCADS1351	Client Side Scripting Lab	0	0	4	40	60	100	2	School
C	MCADS1352	Mini Project	0	0	4	40	60	100	4	
	GP1301	General Proficiency	-	-	-	100	-	100	1	
Total			18	6	8	-		900	31	

SEMESTER IV

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits	Mode
			L	T	P	CIA	ESE	Course Total		
Theory										
C	MCADS1401	Machine Learning	3	1	0	40	60	100	4	IBM
C	MCADS1403	Pattern Recognition	3	1	0	40	60	100	2	Online
Practical										
C	MCADS1451	Industrial Project	-	-	-	200	300	500	20	
	GP1401	General Proficiency	-	-	-	100	-	100	1	
Total			6	2	0	-		800	27	

Legends:

- L Number of Lecture Hours per week
- T Number of Tutorial Hours per week
- P Number of Practical Hours per week
- CIA Continuous Internal Assessment
- ESE End Semester Examination

Credit Summary Chart

Course Category	Semester				Total Credits	%age
	I	II	III	IV		
Basic Sciences	4				4	3.6
Humanities						
Social Sciences						
Professional Subject - Core	20	26	18	6	70	63.6
Professional Subject – Generic Elective/Specialization Elective			12		12	11
Professional Subject – Open Elective						
GP	1	1	1	1	4	3.6
Project Work, Seminar and/or Internship in Industry or elsewhere				20	20	18.2
Total	25	27	31	27	110	100

Discipline wise Credit Summary Chart

Course Category	Semester				Total Credits	%age
	I	II	III	IV		
F	4				4	3.6
C	20	26	18	26	90	81.8
GE/SE			12		12	11
OE						
GP	1	1	1	1	4	3.6
Total	25	27	31	27	110	100

Category of Courses:

- F Foundation Course
- C Core Course
- GE Generic Elective
- OE Open Elective
- SE Specialization Elective

Generic Elective Subjects List

1. MCADS1311: Business Intelligence
2. MCADS1312: Cryptography and Network Security
3. MCADS1313: Cloud Computing
4. MCADS1314: Internet of Things

Specialization Elective I Subjects List

Set A

1. MCADS1321: BigData Analytics
2. MCADS1322: Data Analysis and Visualization
3. MCADS1323: Machine Learning

Set B

1. MCADS1323: Machine Learning
2. MCADS1324: Neural Network and Fuzzy Logic
3. MCADS1325: Cognitive Computing

Specialization Elective II Subjects List

Set A

1. MCADS1331: Data Mining
2. MCADS1332: Data Science Methodology

Set B

1. MCADS1333: Deep Learning and its Applications
2. MCADS1334: Natural Language Processing

Semester I

MCADS1101: Python with Data Science

Note: The course **MCADS1101: Python with Data Science** will be conducted by IBM

MCADS1101: Python with Data Science

Course Objective:

1. Using the frameworks necessary to analyze and interpret data
2. To acquire technical expertise using popular open source analytics frameworks for Data Science
3. To define the Demonstrate knowledge of statistical data analysis techniques utilized in business decision making
4. To learn how to Use data mining software to solve real-world problems.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand programming basics including functions, variables, and data type
2. Data Science lifecycle revolve around using some techniques and other Analytical methods to produce insights and predictions from data to achieve a business objective.
3. Applying and analyzing, is the process of determining which features might be useful in training a model, and then creating those features by transforming raw data found in log files and other sources.
4. Understand Data engineering and data modeling practices using machine learning and Building and create role-playing challenge-based scenarios to propose real-world solutions

Course Contents:

Note: Number of Modules will depend on the credits. One module is of 1 credit

Module	Course Topics	Hours	Credits
I	INTRODUCTION OF PYTHON What is Python, Its advantages and disadvantages, How to run python scripts, How to use variables, String operator and functions, Inputting the data, Working with Boolean and other statements, Use of pandas library for data analysis, Different types of errors that one can encounter while working with Python.	15 Hours	1
II	INTRODUCTION TO DATA SCIENCE What is Data Science, what does a data scientist do, various examples of Data Science in the industries, How Python is deployed for Data Science applications, Various steps in Data Science process like data wrangling, data exploration and selecting the Model	15 Hours	1
III	DATA MANIPULATION AND VISUALIZATION Introduction to NumPy, Pandas and Matplotlib, How to Import NumPy module, what is a data Manipulation using Panda's library? Series object in pandas, Data Frame in	15 Hours	1

	Pandas, Loading and handling data with Pandas, Introduction to Matplotlib, Using Matplotlib for plotting Graphs and charts like Scatter, Bar, Pie, Line, Histogram and more		
IV	SUPERVISED AND UNSUPERVISED LEARNING What is linear regression? Logistic Regression, what is classification? Decision Tree, Confusion Matrix, Random Forest, Naïve Bayes classifier, support vector machine, use cases of unsupervised learning, what is clustering and Types of clustering. What is K-means clustering and Hierarchical Clustering? Step by step calculation of k-means algorithm	15 Hours	1

Suggested Readings:

1. Analytics: Data Science, Data Analysis and Predictive Analytics for Business” by Daniel Covington.
2. Machine Learning for Big Data: Hands-On for Developers and Technical Professionals” by Jason Bell

MCADS1102: Introduction to Soft Computing

Course Objective:

1. The main objective of the soft computing techniques to improve Data Analysis Solution is to strengthen the dialogue between the Statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.
2. Soft computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent system

Learning Outcome: On completion of this course students will be able to:

1. Understand how artificial intelligence influences various modern developments.
2. Understand how Fuzzy System Controller controls various devices.
3. Understand different types of Fuzzy System used in real world.
4. Understand to develop high quality optimized Solution for a problem

Course Contents:

Module	Course Topics	Hours	Credits
I	Introduction: Soft Computing, Differences between Soft Computing and Hard Computing, Requirements of Soft Computing, Applications of Soft Computing Artificial Intelligence & Neural Network: Introduction to Artificial Intelligence, Models of Artificial Neural Network, Learning Rules and Various Activation Functions, Hebbian Learning Rule, Perception Learning Rule, Delta Learning Rule, Widrow – Hoff Learning Rule, Correlation Learning Rule, Winner – Take All Learning Rule, Associative Memories.	15 Hours	1
II	Introduction to Fuzzy System: Fuzzy System, Fuzzy Logic, Fuzzy Sets and Crisp Sets, Evolution of Fuzzy System, Fuzzy Set Operations, Fuzzy to Crisp Conversion, Inference in Fuzzy Logic, Fuzzy Rule Base, Fuzzy Knowledge Base, Fuzzy Controller, Fuzzyfication and Defuzzyfication.	15 Hours	1
III	Type – II Fuzzy Set: Need of Type – II Fuzzy Set, Type – II Fuzzy Set, Generalized Type – II Fuzzy Set, Interval Type- II Fuzzy Set, Fuzzy System, Fuzzy Knowledge Base Modeling Approach: Mamdani Approach, Takagi Sugeno’s Approach, Interpretability and Accuracy Trade- Off in Fuzzy Knowledge Base System, Handling Interpretability and Accuracy Trade-Off in Fuzzy Knowledge Base System,	15 Hours	1
IV	Genetic Algorithm: Basic Concept, Working Principle of Genetic Algorithm, Flow Chart of Genetic Algorithm, Genetic Representation (Encoding), Initialization and Selection, Genetic Operators, Mutation, Generation Cycle, Applications.	15 Hours	1

Suggested Readings:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India
2. N.P. Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press
3. Simon Haykin, "Neural Networks" Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India

MCADS1103: Probability & Statistics

Course Objective:

5. Compute the relevant statistical measures for different types of data.
6. Use the basic probability concept and rules including additive and multiplicative laws.
7. Derive the probability density function of transformation of random variables.
8. Know the various methods of sampling and testing of hypothesis.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. To apply statistical distributions for real life problems.
2. To draw valid inferences based on the analysis of statistical data.
3. Implement the concept probability and probability distribution.
4. Implement the various techniques of testing of hypothesis.

Course Contents:

Module	Course Topics	Hours	Credits
I	Measurement of Central Tendency: Concept of Central Tendency, Types of Central Tendency: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median and Mode. Measures of dispersion: Concept of dispersion, Absolute and Relative Measures of Dispersion: Range, Inter Quartile Range, Mean Deviation, Standard Deviation Correlation and Regression: Concept and types of correlation: Karl Pearson's, Spearman's Rank correlation, Linear Regression: Concept and line of best fit(Y on X and X on Y).	15 Hours	1
II	Probability and Expected Value: Experiment, Sample Space, Event, Types of Event, Probability, Classical Approach, Subjective Approach, Axiomatic Approach & Modern Definition; Probability Theorems (Additive, Multiplicative), Conditional Probability, Bayes's Theorem, Mathematical Expectation, Random Variable & Probability Distribution of Random Variable.	15 Hours	1
III	Theoretical Distributions: Meaning of Theoretical Distributions, Difference between Theoretical & Observed Frequency Distributions, Binomial Distribution, Properties and Constants of Binomial Distribution; Poisson Distribution, Characteristics, Properties and Constants of Poisson Distribution, Poisson Distribution as an Approximation of Binomial Distribution; Normal Distribution, Properties and Constants of Normal Distribution, Relation between Binomial, Poisson & Normal Distribution.	15 Hours	1
	Sampling: Population or Universe, population size, types of population, objective of sampling, methods of sampling.		

IV	<p>Statistical Hypothesis: Types of hypothesis, Procedure of testing the hypothesis, Types of Error, Level of Significance, Degree of freedom. Chi-Square Test, Student's t-Distribution, Analysis of Variance, F-Test.</p> <p>Statistical Quality Control: Introduction, Types of Control Charts, X-Bar Chart, R Chart, C-Chart, Advantages and Limitations of SQC.</p>	15 Hours	1
-----------	--	----------	---

Suggested Readings:

3. S.C. Gupta, "Fundamental of Statistics ", Second Edition
4. Roy D. Yates and David J. Goodman, "Probability and Stochastic Processes-A friendly introduction for Electrical & Computer Engineers, Second Edition
5. Rohatgi V, "An Introduction to probability and Mathematical Statistics" Wiley Eastern Ltd. New Delhi
6. Johnson, S. and Kotz,"Distributions in Statistics", Vol. I, II and III, Houghton and Mifflin

MCA4104: Relational DataBase Management System

Course Objective:

1. To present the fundamental concepts of Database Management.
2. To develop skill of Database Design, Database Languages and Database-System implementation with respect to Relational Database Management System.
3. To develop the concepts of Transaction Processing System, Concurrency control and Recovery procedures in database.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the basic concepts of the database and data models.
2. Design a database using ER diagrams and map ER into Relations and normalize the relations.
3. Develop a simple database applications using normalization.
4. Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

Course Contents:

Module	Course Topics	Hours	Credits
I	Database System Concepts, Database Users, and Architecture: Introduction to Database System with example, Characteristics of the Database Approach: Database Users, Advantages and disadvantages of Using a DBMS, Implication of Database Approach; Data Models, Schemas, and Instances; DBMS Architecture (ANSI/SPARC), Data Independence, Database Languages and Interfaces, Database System Environment; Classification of Database Management Systems.	15 Hours	1
II	Data Modeling & Relational Database Management System: Data Modeling Using the Entity-Relationship Model: Entity Types, Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Rules, and Structural, Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues. Enhanced Entity- Relationship Modeling: Super Classes, Subclasses, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization, Modeling of UNION Types using Categories; The Relational Data Model: Relational Constraints, and the Relational Algebra: Relational Model Concepts, Codd's Rules for relational algebra, Relational Database Schemas. Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra.	15 Hours	1

<p style="text-align: center;">III</p>	<p>SQL and Database Design Theory and Methodology Structured Query Language- The Relational Database Standard: Data Definition, Constraints, and Schema Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Operations and Dealing with Constraint Violations, Queries and Sub Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL, Cursors, Triggers and PL/SQL Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Armstrong Rules, Closure of Attributes, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form</p>	<p style="text-align: center;">15 Hours</p>	<p style="text-align: center;">1</p>
<p style="text-align: center;">IV</p>	<p>Transaction Processing, Concurrency Control and Distributed Database: Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Schedule and Recoverability , Serializability of Schedule, Transaction Support in SQL: Concurrency Control Techniques, Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Technique, Granularity of Data Items, Recovery Concepts: Recovery Technique Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Database Backup and Recovery from Catastrophic Failures, Introduction to Distributed Database.</p>	<p style="text-align: center;">15 Hours</p>	<p style="text-align: center;">1</p>

Suggested Readings:

1. Date C. J.—An Introduction to Data Base System, AddisonWesley.
2. Korth, Silbertz, Sudarshan —Data Base Concepts, McGraw-Hill.
3. Elmasri, Navathe —Fundamentals Of Data Base Systems, AddisonWesley.
4. Bipin C. Desai —An introduction to Data Base Systems, Galgotia Publication.
5. Ramakrishnan, Gehrke —Data Base Management System, McGraw-Hill.
6. R. S. Despandey --SQL/PL SQL for Oracle.
7. Ivan Bayross -- SQL, PL/SQL: The Programming Language of Oracle

MCADS1105: Advance JAVA

Course Objective:

1. To study Java as an Application Programming Language
2. To study various Applications of Java.
3. To focus on developing interactive Applications.
4. To build concepts of database with programming language.
5. To create a web Application & understand the concept of web services.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Students will be able to learn how and why java came about and what makes it so important.
2. Will develop more powerful and flexible components using swing
3. Build complex system from software components
4. Will develop an Application using database.
5. Will develop and deploy web application.

Course Contents:

Module	Course Topics	Hours	Credits
I	Event Handling & Swing: Event Handling: The Delegation Model of Event Handling, Event Classes, Sources, Listeners, Adapter Classes as Helper Classes in Event Handling. Java Swing: Introduction to Swing; Diff B/W AWT and Swing; Components hierarchy; Creating a Swing application; Swing components: JComponent, JLabel, JButton, Actions, JScrollBar, JSlider, JProgressBar, JList, JComboBox; Container and frame: JPanel, JFrame, JDialog, JOptionPane; Menu & Toolbar: JMenuItem, JMenuBar, JPopupMenu; JTable & Tree: JTable & JTree; Layered Panes, Tabbed Panes, Split Panes.	15 Hours	1
II	Distributed Objects: The Roles of Client and Server, Remote Method Invocation (RMI): N-tier Architecture, Distributed object technologies, RMI Architecture, Locating & loading Remote classes, Locating remote objects & providing references to them, Setup for Remote Method Invocation, Parameter Passing in Remote Methods Server Object Activation, Unicast Remote Object, Socket Vs RMI programming.	15 Hours	1
III	Java Database Connectivity (JDBC): Introduction to JDBC, JDBC Installation, JDBC Drivers Type, Connection, JDBC-ODBC Bridge Driver. Driver Manager Class, Java. SQL Package (Connection Interface, Statement Interface, JDBC URLs, Statements-Creating Executing Closing, Result Set-Data Types and Conversions, Prepared Statement, Callable Statement, Mapping SQL and Java Types, Prepared Statement	15 Hours	1

	Interface, Result Set Interface, Result Set Meta Data Interface, SQL Exception class, Advanced Connection Management, Introduction of LDAP.		
IV	<p>Web Applications & Web Services: Java Servlets: Introduction to Server Side Technologies; The JAVA Servlet Architecture, Servlet Life Cycle; HTTP Protocol & HTTP Methods; Web Server & Web container; Servlet Interface; HttpServlet; Generic Servlet; Servlet Config; Servlet Context; Servlet Communication; Retrieving Form Data in a Servlet, Session Tracking Cookies</p> <p>Web Services: Advance Features of Web Services: Working of Web Services, Web API; Contexts and Dependency Injection for the Java EE Platform; Java Persistence API; Security in Java EE; Java EE Supporting Technologies</p> <p>Struts: Introduction to Struts, Overview on MVC Design Pattern, Working of Struts Framework; MVC; Request Handling in Struts; Struts main Components; Sample Program.</p>	15 Hours	1

Suggested Readings:

1. E. Balagurusamy, Programming with Java, Tata McGraw Hill.
2. Patrick Naughton and Herbertz Schildt, "Java 2.0: The Complete Reference", TMH, 1999.
3. Ivan Bayross, "Web technologies", BPB Publication.
4. Deitel & Deitel, "Java How to program", Prentice Hall, 4th Edition, 2000.
5. Gary Cornell and Cay S. Horstmann, "Core Java Vol 1 and Vol 2", TMH.
6. Stephen Asbury, Scott R. Weiner, Wiley, "Developing Java Enterprise Applications", 1998.
7. Java 6 Programming black books Kogent solutions published by dreamtech press edition 2007
8. SOA for the Business Developer, B. Margolis (with J. L. Sharpe), MC Press, 2007.
9. Web Services Platform Architecture, S. Weerawarana, F. Curbera, F. Leymanm, T. Storey and D. F. Ferguson, Pearson Education, 2005.
10. Hibernate in Action, Christian Bauer and Gavin King, Manning Publications Co., 2004
11. Ethan Cerami, "Web Services", O'REILLY Media, 2002.
12. Ralph Moseley, "Developing Web Applications", 2008, Wiley India, New Delhi.
13. Eric Jendrock, D. Carson, I. Evans, D. Gollapudi, K. Haase, C. Srivastha, "The Java EE6 Tutorial", Volume-1, Fourth Edition, 2010, Pearson India, New Delhi
14. Steve Holzner, "Java black book", Paraglyph Press; Second Edit ion (July 1, 2002)

MCA4151: Relational Data Base Management System Lab

Module	Course Topics	Credits
I	<ol style="list-style-type: none">1. Use of DDL for creating objects (Table, Database).2. Use of DML for performing retrieval operations.3. Use of DCL for specifying constraints and authorities on table.4. Use of Aggregate functions.5. Use of String functions.6. Grouping and Ordering operations on table.7. Creating and Performing various operations on Views8. Performing queries for Union, Intersection, Difference, Cartesian Product and Division.9. Performing queries on varies joins and nested queries10. Creating Indexes.	1
II	<ol style="list-style-type: none">1. Writing Programs in PL/SQL2. Understanding and Creating Cursors3. Writing Triggers Program4. Creating Forms, Reports.5. Writing Codes for generating read, Write and Update operations in a transactions using different situations.	1

MCADS1152: Advance JAVA Lab

Module	Course Topics	Credits
I	<ol style="list-style-type: none">1. Implement Event handling to show various movements of mouse.2. Implement Event handling to show use of Listeners.3. Implement Event handling to show use of Adapters.4. Develop a Swing Application using various Swing Components5. Develop a Swing Application using Containers & Frames.6. Develop a Swing Application using Menu bar Toolbar & JTable.7. Implementation of RMI Applications.8. Creation of Bank Account Client/Server Using RMI	1
II	<ol style="list-style-type: none">1. Implementation of Database Connectivity to Create a Table.2. Implementation of Database Connectivity to insert Records in existing Database.3. Implementation of Database Connectivity to delete Records from Database.4. Implementation of Database Connectivity to Modify Records in existing Database.5. Implementation of Servlets to Handle Get Method.6. Implementation of Servlets to Handle Post Method.7. Implementation of Servlets to generate Plain Text.8. Implementation of Servlets to generate HTML.9. Implementation of Java Beans to illustrates the procedure of handling session and print a Hello world using Java Bean10. Implementation of Enterprise java Bean.11. Use of STRUTS Framework in a Web Applications & making sample programme.	1

Semester II:

MCADS1201: Descriptive Analytics

MCADS1202: NoSQL and MONGO DB

Note: The course **MCADS1201: Descriptive Analytics** and **MCADS1202: NoSQL and MONGO DB** will be conducted by IBM

MCADS1201: Descriptive Analytics

Course Objective:

1. Understand how analytics provided a solution to industries using real case studies
2. To learn the importance of analytics and how its transforming the world today
3. Describe a reporting application, its interface, and the different report types and prompts.
4. Learn the implementation of conditional formatting and different layout to work on.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. To understand and implement the concept of configuring and using IBM Cognitive Analytics Tool.
2. Understand how a business analysis software works, and its architecture
3. Create different types of advanced reports.
4. Learn to create gauge, pie charts and RAVE visualizations

Course Contents:

Note: Number of Modules will depend on the credits. One module is of 1 credit

Module	Course Topics	Hours	Credits
I	Changing business with data insight Overview: Understand how analytics is transforming the world, Understand the profound impact of analytics in business decisions, Understand what is analytics and how it works, Understand why business analytics has become important in various industries, Understand the history of analytics and how it has changed today, Understand how to analyze unstructured data, Understand how analytics is making the world smarter, Understand where the future of analytics lies, Explain why successful enterprises need business analytics, Understand how business analytics can help turn data into insight, Understand how predictive analytics is transforming all types of organizations, Explain how analytics supports retail companies, Understand how analytics can reduce crime rates and accidents, Explain the use of analytics in law enforcement and insurance companies, Understand how analytics can affect the future of education, Predictive Analytics Modeler, Big Data Developer, Data Warehouse Developer	15 Hours	1
II	IBM Cognos Analytics for Consumers: Introduction to IBM Cognos Analytics – Reporting What is IBM Cognos Analytics – Reporting, Explore the environment, Examine the side panel, Explore authoring templates, Generate the	15 Hours	1

	report, Create list reports Examine list reports, Group data, Format list columns, Include list headers and footers Focus reports using filters Create filters, Filter your data with advanced detail filters, Create crosstab reports Create a crosstab report, Add measures to crosstab reports, Data sources for crosstabs.		
III	Accessing the data warehouse and present data graphically: Extend reports using calculations Derive additional information from the data source, Add run-time information to your report, Add Date/Time functions to your report, Add string functions to your report. Information integration Components, Functions, Information integration, The challenges, Data workflow, Present data graphically Create a chart report, Different chart options, Create charts containing peer and nested items, Create and reuse custom chart palettes, Add data-driven baselines and markers to charts, Focus reports using prompts Examine parameters and prompts, Create a parameter item on the report, Build a prompt page, Add a prompt item to a report, Use additional report building techniques Enhance report design, Add objects, Organize objects using tables, Break a report into sections, Convert a list to a crosstab, Reuse objects within the same report.	15 Hours	1
IV	Wrap up and planning considerations and customize reports: Wrap up and Planning considerations Summary and Planning Considerations, Data insight, The big picture, Bringing all together, Suggestions for success. Customize reports with conditional formatting Change displays based on conditions, 3 steps for conditional formatting, Step 1. Create a variable, Step 2. Assign the variable to a report object, Step 3. Apply formatting to object based on condition value. Drill-through definitions Let users navigate to related data in IBM Cognos Analytics, Set up drill-through access from a report, Package-based drill through, Specify the values passed to target parameters, Steps to set up a package-based drill-through definition, Limit the items that users can drill through from, Drill Through Assistant. Enhance report layout View the structure of the report, Force page breaks in reports, Horizontal pagination, Modify structures	15 Hours	1

Suggested Readings:

1. IBM Courseware
2. Analytics: Business Intelligence, Algorithms and Statistical Analysis (Predictive Analytics, Data Visualization, Data Analytics, Business Analytics, Decision Analysis, Big Data, Statistical Analysis)” by Todd J Blatt

3. Learning Spark: Lightning-Fast Big Data Analysis by Holden Karau
4. Python for Everybody: Exploring Data in Python 3 by Dr. Charles Russell Severance
Managing Your Business
5. The Wall Street Journal Guide To Information Graphics: The Dos And Don'ts of Presenting
Data, Facts, And Figures

MCADS1202: No SQL & MongoDB

Course Objective:

1. Students will understand fundamental concepts of a number of different NOSQL products.
2. Students will also learn various CRUD operations and the querying mechanisms in NOSQL.
3. Students will also comprehend advanced topics.
4. Use the MongoDB tools to develop and deploy your applications.
5. Implement Java/ Python / PHP web application for a real world problem with MongoDB.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.
4. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Key-Value Pair NoSQL databases.

Course Contents:

Note: Number of Modules will depend on the credits. One module is of 1 credit

Module	Course Topics	Hours	Credits
I	Definition of NOSQL, History of NOSQL and different NOSQL Products Interfacing Exploring Mongo DB java, Exploring Mongo DB Ruby/Python, Interfacing and Interacting with NOSQL Interacting with NOSQL	15 Hours	1
II	Data Model Design (Embedded Data Models and Normalized Data Models), Querying NOSQL stores, Modifying Data Stores and Managing Evolution MongoDB Use Cases, Understanding the NOSQL architecture, Understanding the, NOSQL architecture, Understanding the, NOSQL architecture, Performing CRUD, NOSQL in cloud, Parallel Processing with Map Reduce, Big Data with Hive Surveying Database, Migrating from RDBMS to NOSQL, Query for All Documents in a Collection, Query by a Top Level Field	15 Hours	1

Suggested Readings:

- I. David Hows, “The definitive guide to MongoDB”, 2nd edition, Apress Publication, 2009, 8132230485.
- II. Shakuntala Gupta Edward, “Practical MongoDB ”, Second edition, Apress Publications, 2016, ISBN 1484206487

MCADS1203: Big Data and Data Warehousing

Course Objective:

1. To provide an overview of an exciting growing field of big data and also study the basic technologies that form the foundations of big data.
2. To understand the specialized aspects of big data
3. Learning how to gather and analyze large sets of data to gain useful business understanding.
4. Describe the processes used in developing and managing data warehouse
5. To analyze the data, identify the problems, and choose the relevant models

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the fundamental concepts of big data
2. Understand techniques and issues for handling large data
3. Explain the Data Warehousing operations
4. Explain the Models and Schemas of Data Warehouse

Course Contents:

Module	Course Topics	Hours	Credits
I	Introduction To Big Data: Evolution of Big Data, Best practices for Big Data analytics, Big data characteristics, Characteristics of Big Data applications, Basic overview of Big Data storage and Querying/Analysis: Apache Hadoop, Microsoft HDInsight, NoSQL, Hive, Sqoop, PolyBase, Big data in EXCEL, Presto	15 Hours	1
II	Hadoop: Analyzing data with Hadoop, Scaling out, Hadoop streaming, Hadoop pipes, Concept of Hadoop distributed file system (HDFS) Big Data in Excel: Excel's role in Big Data, Import data into Excel, Handling Semi-Structured Data, Querying, Transforming, Data Cleaning, Data Analysis, Data Visualization	15 Hours	1
III	Data Warehousing: Introduction of Data Warehousing, Types of Data Warehouse, General stages, Components, Architecture, Tools, Database vs Data Warehouse, Characteristics of Data Warehouse, Applications of Data Warehousing, Query Tools, Data Warehouse Bus Architecture; ETL; Types of Data models, Advantages and Disadvantages of Data Model; OLAP: Introduction, Cube, Basic Analytical Operations, Systems types, Benefits of using OLAP services; ROLAP: Introduction, Architecture, Advantages, Tools; MOLAP: Introduction, Architecture, Advantages, Tools, OLTP vs. OLAP, Benefits of OLTP method	15 Hours	1
IV	Dimensional Model: Dimensional Model in Data Warehouse, Elements, Steps, Rules and benefits of Dimensional Modeling	15 Hours	1

	<p>Schemas: Star and SnowFlake Schema in data warehousing, Multidimensional schemas, Galaxy schema, Star Cluster schema</p> <p>Data Mart: Type of Data Mart, Steps in implementing a Datamart, Data Lake: Architecture, concepts, Maturity stages, Difference between Data lakes and Data Warehouse</p>		
--	--	--	--

Suggested Reading:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O' Reilly, 2012.
3. Charis Raftar, "Ultimate Guide to Cleaning data with Excel and Google Sheet: DSM Media 2019.
4. Paul rajponniah Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2013

MCADS1204: Data Privacy Fundamentals

Course Objective:

1. Student able to understand architectural, algorithmic and technological foundations for data privacy.
2. Student able to understand the privacy of individuals, the confidentiality of organizations, and the protection of sensitive information.

Learning Outcome: After successful completion of this course, students will be able to:

1. Understand the concepts of privacy in today's environment.
2. Obtain the understanding of how automation is changing the concepts and expectations concerning privacy and the increasingly interconnected issue of security.
3. Obtain the knowledge of the role of private regulatory and self-help efforts.
4. Have an understanding of how emerging issues are affecting society and business, with a concentration on how information security must shape corporate practices.

Course Contents:

Module	Course Topics	Hours	Credits
I	Introduction -Fundamental Concepts, Definitions, Statistics, Data Privacy Attacks, Data Linking and Profiling, Access Control Models, Role Based Access Control, Privacy Policies, Their Specifications, Languages and Implementation, Privacy Policy Languages, Privacy in Different Domains-Medical, Financial, etc. The Limits Of Privacy: Packing, Reconstruction Attacks, Tracing Attacks	15 Hours	1
II	Differentially Private Learning: PAC Learning, SQ Learning, Convex Optimization , Differential Privacy and Generalization in Learning Data Explosion: Statistics and Lack of Barriers in Collection and Distribution of Person-Specific Information, Mathematical Model for Characterizing and Comparing Real-World Data Sharing Practices and Policies and for Computing Privacy and Risk Measurements, Demographics and Uniqueness.	15 Hours	1
III	Protection Models-Null-Map, K-Map, Wrong Map Survey Of Techniques-Protection Models (Null-Map, K-Map, Wrong Map), Disclosure Control, Inferring Entity Identities, Strength And Weaknesses Of Techniques, Entry Specific Databases. Computation Systems For Protecting Delimited Data-Mingen, Datafly, Mu-Argus, K-Similar, Protecting Textual Documents: Scrub.	15 Hours	1

IV	Technology, Policy, Privacy and Freedom-Medical Privacy Legislation, Policies and Best Practices, Examination Of Privacy Matters Specific to The World Wide Web, Protections Provided by The Freedom Of Information Act, Security: Web, Database, Network, Data, System, Introduction to Encryption, Security Services - Confidentiality, Authentication, Integrity, Access Control Threats and Risks Such as For Example - Viruses, Trojans, Worms	15 Hours	1
-----------	---	----------	---

Suggested Readings:

1. Raghunathan, “The Complete Book of Data Anonymization: From Planning to implementation”, Auerbach Pub, 2013.
2. C Sweeney, “Computational Disclosure Control: A Primer on Data Privacy Protection”, MIT Computer Science, 2002
3. “The Complexity of Differential Privacy form Center for Research on Computation & Society”, John A. Paulson School of Engineering & Applied Sciences Harvard University Cambridge, Massachusetts USA
https://privacytools.seas.harvard.edu/files/privacytools/files/complexityprivacy_1.pdf
4. “The Algorithmic Foundations of Differential Privacy”, from Foundations and TrendsR©in Theoretical Computer Science, Vol. 9, Nos. 3–4 (2014) 211–407c©2014 C. Dwork and A. RothDOI: 10.1561/0400000042
<https://www.cis.upenn.edu/~aaroht/Papers/privacybook.pdf>

MCADS1205: Web Technology & Application Development Using Python

Course Objectives:

1. The Subject focuses on designing of web pages using HTML, DHTML and CSS.
2. Provides basic knowledge of Python Programming language.
3. To focus on various data structures and object oriented concept in Python.
4. Design and Develop web applications using Django framework.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Acquire programming skills in core Python.
2. Understand the various data structures available in Python programming language and apply them in solving computational problems.
3. Understand the object oriented concept using Python.
4. Develop the ability to write database applications using Django in Python.

Course Contents:

Module	Course Topics	Hours	Credits
I	HTML, DHTML: Introduction to HTML5; Introduction to Text Formatting tags; Types of Lists: Ordered, Unordered, Definition lists; Table tags: Methods to Create Tables, Attributes of Table tag, Col span and Rowspan; Block level and Inline elements; Classes; Entities; QR Generator and Validator; Frame tags and its Attributes; Form tag: Creation of Forms, Textbox, Radio Button, Hidden etc; Introduction to DHTML; Document Object Model; Style Sheets: Need of CSS; Types of Style Sheet: Inline, Internal and External	15 Hours	1
II	Introduction to Python: Indentation; Python character set; Tokens; Core Data Types; print(); Assigning values to variable; Multiple Assignments; input(); eval(); Formatting Number & String; Python inbuilt mathematical function; Operators & Expression; Decision Statement; Loop Control Statement; range(); Nested Loops, break, continue, pass; Functions: Syntax; use of function; return statement; parameters & arguments; Scope of a variable; Recursive function; Lambda function; Python Modules: creating, importing; Built-in Modules: math, random, time & date module	15 Hours	1
III	String: Str class; index[] operator; String operators; String operations; Built-in method; Python Data Structure: List, Tuples, Dictionary, Sets; Object Oriented Concepts: Defining Classes, Special Class, Attribute, Accessibility, Method Overloading, Inheritance, Method Overriding	15 Hours	1
IV	Django Framework: Introduction; Installation; Apps Life Cycle; Admin Interface; Creating Views; URL mapping; Template System; Django Model: Model Relationship, Querying Models & Connecting to MySQL database; Django Forms: Understand the process of building,	15 Hours	1

	Handling, Submitting & Validating HTML forms using Django; Web application using Django framework		
--	---	--	--

Suggested Readings:

1. Ashok N. Kamthane & Amit A. Kamthane, Programming and Problem Solving with Python, McGraw Hill Educations
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning, ISBN: 978- 1111822705.
3. Jake VanderPlas “Python Data Science Handbook” O’Reilly Publications
4. David Beazley, “Python Essential Reference (4th Edition) “ Addison Wesley
5. Vernon L. Ceder,” The Quick Python Book, Second Edition”, Manning Publications
6. Samuel Dauzon, Aidas Bendoraitis, Arun Ravindran ,”Django: Web Development with Python”, packt publications
7. O’Reilly , ”Web Development with Django Cookbook”, 2016, Packt Publishing

MCADS1206: Advance .Net Framework and C#

Pre Requisite: “C# Basics”.

Course Objective:

1. To present the fundamental concepts of Windows Desktop and Website development with machine learning and data science through Microsoft Technologies.
2. To impart solid foundation and develop the skill of Web Development through C# Programming.
3. To develop the concepts of static and dynamic Web Pages and make the students familiar with Client Server Technology, Distributed Applications and Web Services.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of .Net technology.
2. Develop the skills in ASP.NET with C# Programming.
3. Understand the Microsoft Database Connectivity.
4. Able to understand the Static and Dynamic web pages.
5. Able to understand about Distributed applications.
6. Able to understand Machine Learning and data science using ML.Net.

Course Contents:

Module	Course Topics	Hours	Credits
I	.Net Framework: Introduction and Origin of .Net technology; Framework Components, Common Language Runtime(CLR) and FCL; Managed and Unmanaged Code; Common Type System(CTS) & Common Language Specification (CLS);Microsoft Intermediate Language (MSIL) and Metadata; Just-In-Time Compilation (JIT); Garbage Collection; Base Classes and Ms.Net Namespaces. Object and Classes: Properties (Read, Write), Indexers, Inheritance (Multilevel and Hierarchical), Constructor Polymorphism (Runtime, Compile Time), Operator Overloading, Interfaces, Delegates and Events, Boxing and Un-boxing.	15 Hours	1
II	C# Libraries and Assemblies: Input output (Streams Classes); Multithreading; Networking and Sockets; Managing Console I/O Operations; .NET Assemblies: Type of Assemblies, GAC (Global Assembly Cache), Concept of Strong Names, Global ASAX Files; Caching Concepts: Page Output Caching, Page Fragment Caching; State management: Session Object, Hidden Fields, View State, Cookies, Cross page posting; Introduction to Generics; Web Configuration and Machine Configuration Files. Windows and Website Development: Windows Forms (A Skeletal Form Based Windows Program, Remoting: Server Activated Object, Client Activated Object; Marshalling:	15 Hours	1

	Marshal by value, Marshal by reference; Debugging, Exceptions and Error Handling; ASP.NET Web Form Controls: User controls and Server Controls; Web Services: UDDI, DISCO, WSDL; ADO.NET: Architecture, Difference between Dataset and Data Reader, Connection and Command Object; Distributed applications; Reflection; Globalization and Localization; Authentication and Authorizations; XML in .NET.		
III	Advanced Concepts: REST AND SOAP : Rest , Restful, Soap, WCF, WPF, Implementation of Rest and Soap, Restful Vs Soap Web server : web server , types , web server used in .net Ajax Controls: AJAX and need for AJAX, Implement with JavaScript, ASP.NET AJAX – Update Panel, Update Progress etc., ASP.NET Ajax Control toolkit, Client side Template Rendering – Data View control	15 Hours	1
IV	Introduction to Machine Learning in .Net : ML v/s AI v/s DL ,ML.NET, Setting up Environment , ML.Net SDK, ML.Net Flow, ML Terminology, Create Regression, Cross Validate Model, Algorithms & Hyper parameters, Data load and save from different sources , Model save and load, Classification: binary, Multiclass, Computer vision , Training Overview :ML with ML.NET and Big Data with Spark for .NET	15 Hours	1

Suggested Readings:

1. Balagurusamy —Programming .with c# —, Tata McGraw Hill Publication.
2. ASP.NET 3.0 Black Book II, Dreamtech Press.
3. Beginning ASP.NET3.0 II, WROX Publication.
4. Stephen C. Perry, Atul Kahae, Stephen Walther, Joseph Mayo, —Essential of .NET and Related Technologies with a focus on C#, XML, ASP.net and ADO.net, Pearson, 2nd Edition, 2009.
5. Hands-On Machine Learning with ML.NET: Getting started with Microsoft ML.NET to implement popular machine learning algorithms in C# Paperback – Import, 27 March 2020 by Jarred Capellman
6. Microsoft ML.Net Machine Learning For .Net Developers Using C#.NET (Microsoft ML.NET C# Machine Learning Programming Series)by Dr. A. F. Salam (Author), Jakia Salam

MCADS1251: Web Technology & Application Development Using Python Lab

Module	Course Topics	Credits
I	<ol style="list-style-type: none">1. Implementation of List Tags in HTML2. Implementation of Table Tag in HTML.3. Implementation of Frameset Tag in HTML.4. Implementation of different Form Tags in HTML.5. Implementation of Cascading Style Sheet in Web Pages6. Python Input Methods for Competitive Programming, Python7. Output using print() function Python end parameter in print(),if, else, if elif ladder , for loop, range function implementation8. Using different functions in strings9. Practical implementation of list, dictionary, tuple, set10. Making module for functions, and importing them different types of imports in python	1
II	<ol style="list-style-type: none">1. Creating classes, Creating objects,2. Creating and implementing function calls, constructor, and self-keyword implementation, super method3. Installing Django and creating projects4. Creating templates5. Adding administration panel to project6. Interacting with database and models7. Implementation of advanced views and URLconfs8. Creating and validating forms9. Handling user input with forms	1

MCADS1252: Advance .Net Framework and C# Lab

Module	Course Topics	Credits
I	<ol style="list-style-type: none"> 1. Implementation of Decision Making and Branching Statements. 2. Implementation Iterative Statements on Console Applications. 3. Implementation of Enum and Structures on console Applications. 4. Implementation of Arrays and ArrayList on Console Applications. 5. Implementation of Boxing and UnBoxing on Console Applications. 6. Implementation of Strings on Console Applications. 7. Implementation of Inheritance and Polymorphism 8. Implement concepts of Inheritance, visual inheritance and Interface. 9. Construct the C# application to implement the Operator Overloading. 10. Implementation of Delegates on Console Applications. 11. Implementation of Multithreading in C# 12. Implementation of Interfaces on Console Applications. 13. Implementation of Events on Console Applications. 14. Implementation of Properties and Indexers on Console Applications. 15. Implement Master Form with Windows application. 16. Implementation of Networking and Socket Programming in asp.net. 17. Implementation of Server Side Controls in asp.net. 18. Implementation of Database Connectivity in asp.Net 19. Implementation of various Data Rendering Controls in asp.Net. 20. Implementation of Web Services in asp.Net Applications. 21. Implementation of Remoting in asp.Net Applications. 	1
II	<ol style="list-style-type: none"> 1. Implement web application using ASP.NET with web controls. 2. Use Dataset, Data Reader, XML Reader & Data Sources (SQL, Object & XML) with Any Windows or Web Application. 3. Write a code for web application to provide input validations using Input Valuators. 4. Create a Web application that illustrates the use of themes and master pages with Site-Map. 5. Create a Web Application in ASP.NET using various CSS 6. Implement the concept of state management in a web application. 7. Implement code in ASP.NET that creates and consumes Web service by any web application. 8. Create the simple application to demonstrate the WPF concept. 9. Create the simple application to demonstrate the WCF concept. 10. Setting up Environment in .Net for ML 11. Create the simple to Program using ML.Net 12. Data load and save from different sources in ML.Net. 13. Model save and load in ML.Net. 14. Train your model in ML.Net. 	1

MCADS1301: Big Data Analytics and Architecture

Note: Syllabus Provided by IBM

Course Objective:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
3. To explain the importance of Bigdata, spark
4. To strengthen the understanding of basic concepts of spark and scala.
5. To prepare sample project in hadoop.
6. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
7. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction
2. Understand the MapReduce model v1 and review java code
3. Develop an understanding of the complete open-source Hadoop ecosystem and its near-term future directions
4. Mining of Big Data.
5. Processing of data streams

Course Contents:

Module	Course Topics	Hours	Credits
I	Describe the complete open-source Hadoop ecosystem and its near-term future directions, Describe the major challenges of data, Explain how the growth of interconnected devices contributes big data, List real-life examples of Big Data, List the types of Big Data, Identify Big Data use cases, Describe the evolution from traditional data processing to big data processing Hadoop and HDFS, Loading data with Sqoop, Import and export data from Mysql to hive	15 Hours	1
II	Describe the functions and features of HDP, List the IBM added value components., Describe the purpose and benefits of each added value componen), Describe the MapReduce programming model, Describe Hadoop v1 and MapReduce v1 and list their limitations, Describe Apache Hadoop v2 and YARN, Compare Hadoop v2 and YARN with Hadoop v1.	15 Hours	1
III	Lambda Architecture in Big Data; Batch processing and speed processing in Lambda architecture Mining Big Data;	15 Hours	1

	Data streams and analysis of time series; Recommender systems; Social network analysis.		
IV	Introduction to Scala and Spark; Analytics using Spark SQL; introduction to all spark libraries with their working (Spark core Spark MLlib spark Graph x Spark streaming and Spark SQL), Apache Storm, Components of Spark Unified stack, RDD, Word count using scala, Introduction to queuing systems. Eg. Kafka, Introduction to Data storage and processing; Defining Hadoop Cluster Requirements; Maximizing HDFS Robustness; Managing Resources and cluster Health; Maintaining a cluster; Implementing Data Ingress and Egress	15 Hours	1

Suggested Readings:

1. Bigdata Analytics by Shankarmani wiley
2. IBM material
3. Hadoop in Practice. by Alex Holmes.

MCADS1302: Artificial Intelligence

Note: Syllabus Provided by IBM

Course Objective:

1. Describe the field of AI and its subfields machine learning, NLP and computer vision
2. Describe the types of AI List the factors that influenced the advancements of AI in recent years
3. List applications of AI Explain what Machine Learning is
4. Describe the types of machine learning: Supervised learning, unsupervised learning, and deep learning
5. Explain neural networks
6. Explain what NLP is and list its applications
7. Explain what computer vision is and list its applications

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Students will learn how to work with Watson services.
2. Student will understand the working of chatbot and computer vision
3. Students will understand the basics of AI.

Course Contents:

Module	Course Topics	Hours	Credits
I	Artificial Intelligence Overview: AI impact in the world today, History and evolution of AI, AI Technologies, Eras of Computing, types & main focus of AI, ML & its types, Neural Networks, NLP & processes, Use Cases, Computer Vision tools and use cases, Cognitive Computing, Setting up of IBM Bluemix Account, AI Trends, Limits of Machine and Human, AI predictions in next 5 years.	15 Hours	1
II	Artificial Intelligence Foundation: AI industry adoption approaches: AI Industry impact, autonomous Vehicles, Smart robotics, future workforce and AI, IBM Watson and real-world problems, DeepQA Architecture, Commercialization of Watson, Watson Services – capabilities of each Watson service, Watson Knowledge Studio, Usage of Watson API explorer.	15 Hours	1
III	NLP and NLC: NLP – Processes, Tools and services of NLP, NLP Use cases, Different components of NLP, Challenges with NLU, NLP Pipeline. Capabilities of IBM Watson NLC, NLU and its capabilities, Watson Tone Analyzer, Watson Discovery Service, Using Discovery API, UIMA Pipeline utilized in Watson jeopardy, virtual agent for enterprise	15 Hours	1
IV	Chatbots: Chatbot and its applications, growing popularity of chatbots, tools and services for chatbots, Workspace, Intent,	15 Hours	1

	<p>entity & dialog nodes. Nodes in a dialog, Advanced Features of a chatbot, Creation of Watson Assistant Instance, Add Intents and test in slack.</p> <p>Computer Vision: AI vision through deep learning, CV – history and advancement with AI, CU Use Cases, Pipeline within a CV application, Feature Extraction, image classification and recognition, IBM Visual Recognition Service, Image classification and object detection , face recognition and image preprocessing using opencv python library</p>		
--	---	--	--

Suggested Readings:

1. Elaine A Rich, “Artificial Intelligence”, Tata McGraw-Hill Publishing Company Limited.
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, Shroff Publishers & Distributors Pvt. Ltd.

MCADS1303: Client Side Scripting

Course Objective:

1. To develop dynamic web pages using Javascript.
2. To create event based web forms using Javascript.
3. To create a dynamic, interactive website quickly, confidently and successfully.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Create dynamic web pages using forms, handling cookies and persistent cookies.
2. Move this skill upward by creating some degree of user interactivity using Javascript.
3. Creating regular expressions for validations and creating menus and navigations in web pages.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Basics of JavaScript Programming: Features, Advantages, Disadvantages, Data Types; Object Name, Property, Method, Dot syntax, Main event; Operators and Expressions; Statements: Selection Statements, Looping Statements, Loop Control Statements; Class and Properties; Arrays: declaring, initializing, looping, sorting, Objects as Associative array; Functions: Defining, Scope of variable and argument; Calling a function: Without argument, With argument, from HTML, calling another function, returning values	15 Hours	1
II	String: manipulating, joining, retrieving, dividing text, copying, converting string to number and numbers to string, changing case, finding Unicode; Form and Event Handling: Properties, Methods, Input elements; form; Changing attribute value dynamically; Changing option list dynamically; Evaluating checkbox selection; changing a label dynamically; Manipulating form elements; Intrinsic JavaScript functions	15 Hours	1
III	Cookies and Browser data: creating, reading, writing, deleting cookies, setting the expiration date of cookie; Browser: opening a window, giving the window focus, window position, changing the content of window, closing a window, scrolling a web page, multiple windows at once, creating a web page in new window; JavaScript in URLs, JavaScript security, Timers, Browser location and history	15 Hours	1

IV	Regular Expression, Rollover, Frames, Menus and Navigation: Regular Expression: language, non matching characters, range of characters, matching digits, non digits, punctuations, symbols, words, replacing text, returning the matched char regular expression, object properties; Frames: creation, invisible borders, calling, changing content, focus, writing of child window, accessing elements of another child window; Rollover: creating, text, Multiple actions, more efficient rollover; Status bar: builds a static message, changing the message using rollover, moving the message along the status bar; Menus: Creating, dynamically changing menu, validation, Floating, chain select, tab, pop-up, sliding, highlighted menu, folding a tree, context, scrollable, side bar menu.	15 Hours	1
----	--	----------	---

Suggested Readings:

1. Dr. Minakshi A. Thakor, "Client Side Scripting language", June 2019
2. Anuradha A. Puntambekar, "Client Side Scripting language", Technical Publications, June 2019
3. Keogh, Jim , "JavaScript Demystified", McGraw-Hill, 2015, New Delhi .
4. Beginning JavaScript Wilton, Paul, Wily India, New Delhi, 2015.
5. McPeak, Jeremy and Wilton, Paul Moncur, Michael, "JavaScript in 24 hours SAMS teach yourself , Wily India, New Delhi, 2015
6. James L Mohler and Jon Duff, "Designing interactive web sites", Delmar Thomson Learning.

MCADS1321: Big Data Analytics

Course Objective:

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop System
6. Apply analytics on Structured, Unstructured Data.

Learning Outcome: The students will be able to:

1. Identify Big Data and its Business Implications.
2. List the components of Hadoop and Hadoop System
3. Access and Process Data on Distributed File System
4. Manage Job Execution in Hadoop Environment
5. Develop Big Data Solutions using Hadoop System

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction to Big Data: Convergence of key trends, Unstructured data, Industry examples of big data, Web Analytics, Big Data and Marketing, Fraud and Risk in Big Data, Credit Risk Management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, Introduction to Hadoop, Open Source Technologies, Cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics	15 Hours	1
II	NoSQL: Introduction to NoSQL, Aggregate Data Models, key-value and document data models, relationships, graph databases, schemeless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map reduce calculations.	15 Hours	1
III	Hadoop : Data format, analysing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.	15 Hours	1

IV	Big data Analysis: Hbase, data model and implementations, Hbase clients, Hbase examples, praxis, Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	15 Hours	1
-----------	--	----------	---

Suggested Readings:

1. Raj Kamal, Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill, 2018.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business”, John Wiley & Sons, 2013.
3. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O'Reilley, 2012.
4. Eric Sammer, “Hadoop Operations”, O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, “Programming Hive”, O'Reilley, 2012.
6. Lars George, “HBase: The Definitive Guide”, O'Reilley, 2011.
7. Eben Hewitt, “Cassandra: The Definitive Guide”, O'Reilley, 2010.

MCADS1322: Data Analysis and Visualization

Course Objective:

1. To learn different statistical methods for Data visualization
2. To learn basics of tableau and concepts of visualization.
3. To learn about open source visualization tool seaborn and matplotlib.
4. To learn functionalities and usages of Seaborn and matplotlib.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand and apply statistical methods for Data visualization.
2. Gain knowledge of tableau and develop understanding of visualization.
3. Identify appropriate data visualization techniques given particular requirements imposed by the data.
4. Acquire and Apply data visualization tools on various data sets.

Course Contents:

Module	Course Topics	Hours	Credit
I	Introduction to Tableau: Introducing real time dashboards, creating real time, dashboards with Tableau, build a Tableau dashboard, real time dashboard updates in Tableau, organizing your Tableau dashboard, formatting your Tableau dashboard, interactive Tableau dashboard, Tableau dashboard starters, Tableau dashboard extensions, Tableau dashboards and story points, sharing your tableau dashboard.	15 Hours	1
II	Data Visualization Concepts: Storytelling process, interpreting context, analysis types, who, what and how of storytelling, Visualization for storytelling, Graphical tools for data elaboration, storytelling scenarios, storyboarding, Visual selection, slope graphs, bar charts and types of bar charts, clutter and clutter elimination, Gestalt principle, story design best practices, tools for storytelling, Decluttering, crafting visual data, visual design concerns, storytelling with power BI, model visual and Tableau	15 Hours	1
III	Open Source Data Visualization with Seaborn: Introduction to Seaborn, install Seaborn, Simple Univariate distributions, configure univariate, distribution plots, Simple Bivariate distributions, explore different types of Bivariate distributions, analyse multiple variable pairs, Regression plots, themes and styles in seaborn, searching for patterns in a dataset, configuring plot aesthetics, normal distribution and	15 Hours	1

	outliers, distributions within categories, part distributions within categories part, analysing categories with facet grids, part, analysing categories with facet grids, part ,introducing colour palettes , using colour palettes		
IV	Open Source Data Visualization with Matplotlib: An Introduction To Matplotlib, analysing Data Using NumPy and Pandas, visualizing , Univariate and Bivariate distributions, summary statistics using native , Python functions, Summary Statistics using NumPy, summary statistics using the SciPy library, Correlation and covariance, Z-score , relevance of data visualization for business, libraries for data visualization in python, Python data visualization environment, configuration, matplotlib libraries for visualization, bar chart using ggplot, bokeh and pygal, select visualization libraries, interactive graphs and image files, plot graphs, multiple lines in graphs, using scatter plots, using line graphs, using bar, charts, using box and whisker plots, using histograms, using a bubble plot, chart types , stacked bar plot, animate plots with matplotlib, plotting in Jupyter notebook	15 Hours	1

Suggested Readings:

1. Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly Media, April 2019, ISBN 978-1-492-03108-6
2. Alexander Loth, Visual Analytics with Tableau, Wiley, May 2019, ISBN: 978-1-119-56020-3
3. Mr Alboukadel Kassambara, "R Graphics Essentials for Great Data Visualization", CreateSpace Independent Publishing Platform, 1st edition (14 November 2017)
4. R. Nageswara Rao, "Core Python Programming", Second Edition, Dreamtech Press.
5. E. Tufte., "The Visual Display of Quantitative Information", Graphics Press, 2001
6. E. Tufte, "Envisioning Information", Graphics Press, 1990.

MCADS1323: Machine Learning

Course Objective:

1. Able to understand the concepts of Machine Learning.
2. Understand the Knowledge representation issues and concept learning.
3. Understand and apply decision tree learning
4. Understand instance-based learning and reinforcement learning using python.

Learning Outcomes:

1. Develop an appreciation for what is involved in Learning models from data
2. Understand a wide variety of learning algorithms using python
3. Understand how to evaluate models generated from data
4. Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Course Contents:

Module	Course Topics	Total	Credits
I	Introduction: Machine Learning Foundations, Need of Machine Learning, Design of a Learning System, Types of Machine Learning, Supervised Learning and Unsupervised Learning, Applications of Machine Learning. Components of Python ML Ecosystem: Installation and Execution of Jupyter Notebook, NumPy, pandas, Scikit-learn, matplotlib	15 Hours	1
II	Data Pre-Processing: Data Pre-processing, Need of Data Pre-processing, csv Data Loading for ML Projects Numpy and Pandas. Data preprocessing with pandas: Handling Empty Cell, Data in Wrong Format, Duplicate Data. Data Pre-processing by Scikit-learn: Scaling, Normalization, Standardization, Data Labeling	15 Hours	1
III	Supervised Learning: Classification and Regression, Generalization, Overfitting, and Underfitting, Supervised Machine Learning Algorithms: Support Vector Machine (SVM), Working of SVM, Implementation, Decision Tree: Working and Implementation, Naïve Bayes Classifier: Introduction to Naïve Bayes Algorithm, Building a model Using Naïve Bayes Classifier, Random Forest: Working and implementation. Measuring Classifier Performance	15 Hours	1
IV	Un-Supervised Learning: Types of Un-Supervised Learning, Challenges, Introduction to Clustering, K-means Clustering Algorithm, Working and Implementation of K-means Clustering, Hierarchical Clustering: Introduction to Hierarchical Clustering, Agglomerative Hierarchical Clustering, Density-Based Method: DBSCAN, Comparing and Evaluating Clustering Algorithms	15 Hours	1

Suggestive Readings:

1. Andreas C. Müller & Sarah Guido, “Introduction to Machine Learning with Python A Guide for Data Scientists”, O'Reilly, 2017.
2. Manohar Swamynathan, “Mastering Machine Learning with Python in Six Steps”, Apress 2017.
3. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, O'Reilly, 2017

BCADS 1324: Neural Network and Fuzzy Logic

Course Objective:

1. To introduce the fundamental concepts of Artificial Neural Network.
2. To equip students with the learning process of ANN.
3. Students will get the basic understanding of fuzzy set fundamentals.
4. Understand the importance of tolerance of imprecision and uncertainty handling by Fuzzy Logic

Learning Outcome: On completion of this course students will be able to:

1. Understand how human brain works and how ANN mimic that.
2. Understand different learning rules and architecture of perceptron.
3. Understand different types of Fuzzy System used in real world.
4. Understand fuzzy logic, Type II and Interval Type II Fuzzy Sets.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction to ANN: Biological Neural Network: Neuron, Nerve structure and synapse, Features, structure and working of Biological Neuron, Basics of Artificial Neural Networks: Artificial Neuron and its model, Models of Neuron: Pitts model, Perceptron, Adaline model, Characteristics of Neural Networks, Neural Network Architectures: Single Layer Feedforward Network, Multilayer Feedforward Network, Recurrent Networks, Various Activation Functions.	15 Hours	1
II	Learning: Concept of Learning, Types of Learning, Learning Rules: Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow and Hoff LMS Learning Law, Correlation Learning Law, Winner – Take All Learning Rule, Single Layer Perceptron: Adaptive Filtering Problem, Least Mean Square Algorithm, Learning Curves, Multilayer Perceptron: Back Propagation Algorithm XOR Problem,	15 Hours	1
III	Fuzzy Set Theory: Fuzzy versus Crisp, Crisp Sets: Operations on Crisp Sets, Properties of Crisp Sets, Fuzzy Sets: Membership Function, Basic Fuzzy Set Operations, Properties of Fuzzy Sets, Crisp Relations: Cartesian Product, Other Crisp Relations, Operations on Relations, Fuzzy Relations: Fuzzy Cartesian Product, Operations on Fuzzy Relations.	15 Hours	1
IV	Fuzzy Systems: Crisp Logic: Laws of Propositional Logic, Inference in Propositional Logic, Predicate Logic: Interpretations of Predicate Logic Formula, Inference in Predicate Logic, Fuzzy Logic: Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based System, Defuzzification Methods. Introduction to Type II and Interval Type II Fuzzy Sets.	15 Hours	1

Suggested Readings:

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India.
2. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India
3. Siman Haykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India

MCADS1325: Cognitive Computing

Course Objective:

1. This course delves into the field of cognitive computing and its ramifications in today's environment of big data analytics and evidence-based decision-making.
2. This course will address cognitive computing design ideas, natural language processing, and knowledge management.
3. Students will have the chance to create cognitive applications as well as investigate the influence of knowledge-based artificial intelligence and deep learning data science is a branch of study.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Recognize and discuss what cognitive computing is and how it differs from other techniques.
2. Prepare for and use the primary cognitive computing tools.
3. Develop and implement a cognitive computing-based project.
4. Recognize and discuss cognitive computing's business implications.

Course Contents:

Module	Course Topics	Hours	Credits
I	The Foundation of Cognitive Computing: Theory of Cognition, Elements of a Cognitive System, Design Principles for Cognitive Systems, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.	15 Hours	1
II	Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems, Relationship Between Big Data and Cognitive Computing.	15 Hours	1
III	Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Defining Taxonomies and Ontologies, Models for Knowledge Representation, The Importance of Persistence and State, Implementation Considerations, Applying Advanced Analytics to Cognitive Computing, Predictive Analytics, Text Analytics, Image Analytics and Speech Analytics	15 Hours	1

IV	The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Business Implications of Cognitive Computing, IBM's Watson as a Cognitive System, Emerging Cognitive Computing Areas	15 Hours	1
-----------	---	----------	---

Suggested Readings:

1. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.
2. Masood, Adnan, Hashmi, Adnan, "Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow", 2015
3. Peter Fingar, "Cognitive Computing: A Brief Guide for Game Changers", PHI Publication, 2015
4. Rob High, Tanmay Bakshi, "Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service", IBM Book Series, 2019

MCADS1331: Data Mining

Course Objective:

1. Introduce data mining as a cutting edge business intelligence method and acquaint the students with the Data Mining techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.
2. Describing and demonstrating basic data mining algorithms, methods, and tools.
3. Identifying business applications of data mining.
4. Overview of the developing areas - web mining, text mining, and others.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Understand knowledge discovery, data mining, types of data and attributes and major issues of data mining.
2. Discover interesting patterns from large amount of data to solve problems and make predictions.
3. Select and apply proper data mining algorithms to build analytical applications.
4. Understand mining complex data.

Course Content

Module	Course Topics	Total	Credits
I	Introduction: Data Mining; Architecture of Data Mining System; Types of Data: Relational Database, Data Warehouse, Transactional Data, Sequential Data, Data Stream, Text Data and Web Data; Data Mining Functionalities; Technologies Used for Data Mining; Applications; Major Issues in Data Mining. Data: Types of Attributes; Statistical Descriptions of Data; Data Visualization; Measuring Data Similarity and Dissimilarity.	15 Hours	1
II	Data Preprocessing: Data Preprocessing and its Need, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. Association Rule Mining: Mining Frequent Itemsets: Apriori Algorithm, FP-Growth Algorithm; Generating Association Rules From Frequent Itemsets; Pattern Evaluation Methods.	15 Hours	1
III	Classification: General Approach; Basic Concept of Supervised and Unsupervised Learning; Classification by Decision Tree Induction; Bayesian Classification; Rule based Classification; Nearest Neighbor Classifier; Classification by Backpropagation; Support Vector Machines; Classification Model Evaluation and Selection; Clustering: Overview of Basic Clustering Methods; Partitioning Methods: K-Means, k-Medoids; Hierarchical Methods: Agglomerative Versus Divisive Hierarchical	15 Hours	1

	Clustering, BIRCH; Density-Based Method: DBSCAN; Grid-Based Method: STING; Evaluation of Clustering Methods; Basic Concept and Challenges of Outlier Analysis.		
IV	Mining Complex Data: Sequence Data, Graphs and Networks, Spatial Data, Spatiotemporal Data and Moving Objects, Cyber-Physical System Data, Multimedia Data, Text Data, Web Data, Data Streams. Data Mining Applications; Privacy, Security, and Social Impacts of Data Mining	15 Hours	1

Suggested Readings:

1. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining Concepts and Techniques”, Elsevier.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, PHI
3. Max Bramer, “Principles of Data Mining”, Springer

MCADS1332: Data Science Methodology

Course Objective:

1. Distinguish the various discipline that contribute to a successful data science effort.
2. Understand the processes of data science identifying the problem to be solved, data collection, preparation, modelling, evaluation and visualization.
3. Develop and design the challenges that arise in data sciences.
- 4 Be able to identify the application of the type of algorithm based on the type of the problem.
5. Be comfortable using commercial and open source tools like python language and its associated libraries for data analytics and visualization.

Learning Outcomes: Upon successful completion of the course the student will be able to:

1. Explore the fundamental concepts of data science
2. Understand data analysis techniques for applications handling large data
3. Make data-driven predictions through statistical inference.
4. Basic and advanced analytic methods and an introduction to big data analytics technology and tools.

Course Contents:

Module	Course Topics	Hours	Credits
I	Introduction To Data Science: Definition, Concepts of Data, Data Problems and Solutions, Data Acquisition, Pre-Processing. Data Visualization: Design of Data Collection Formats with Illustration, Principles of Data Visualization, Visualization Types	15 Hours	1
II	Predictive Modelling: Regression, Classification, Naïve Bayes Classifier, SVM for classification, Bagging & Boosting Ensemble Methods, Data Pre-processing, Model. Data Mining: Dimensionality Reduction, Clustering, Association Rules, Anomaly Detection, Network Analysis and Recommender Systems.	15 Hours	1
III	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.	15 Hours	1
IV	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.	15 Hours	1

Suggested Readings:

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

MCADS1333: Deep Learning And Its Applications

Course Objective:

1. The subject provides the fundamental concepts of Deep Learning and its applications in various fields.
2. The subject covers the fundamentals of linear algebra, neural networks, including sigmoid neurons, multi-layered perceptrons, recurrent neural networks, convolutional neural networks, encoder/decoders, and attention networks, as well as the training procedures for these neural networks and their applications.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Learn the fundamentals of deep learning models and how to apply them.
2. Understand the architecture of various neural networks and how to train them.
3. Recognize the distinction between sigmoid neurons and CNN.
4. Know the foundations of sophisticated neural networks like encoder/decoder and attention networks.

Prerequisites: Linear Algebra, Probability, and Numerical Computation are all needed preliminaries.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Applied mathematics: Introduction to scalar, vectors, matrices, and tensors, Special types of matrices, matrix operations, linear Dependence, Span, Norms, Eigen Decomposition, Singular value Decomposition, Determinant, Principal Component Analysis Revisiting concepts of neural network: Perceptrons, Multi-Layer Perceptron, Activation function, Feedforward process, Error function, Optimization algorithms, Back propagation.	15 Hours	1
II	Convolutional Neural Network: Convolution and its type, Layers of CNN and its working(Convolution layer, Pooling layer, Fully Connected Layer), Advance CNN architecture: LeNet, Alexnet,VGGNet, GoogleNet, ResNet, Train network for image classification, Semantic Segmentation, Hyperparameter optimization, Transfer learning, Difference between CNN and Feed Forward Neural Network	15 Hours	1

	Application of CNN: Case Study: Segmentation of Brain Tumor from MRI using CNN or any other similar case study		
III	Recurrent Neural Network: Introduction, Architecture, Deep RNNs, Bi-RNN Algorithm to train the RNN: Backpropagation through time, Truncated Backpropagation Through Time, Challenges in training the RNN, Vanishing gradient Types of RNN: LSTM, Gated RNN Application of RNN: Case Study: Sequence classification or any other similar case study	15 Hours	1
IV	Encoder/ Decoder: Introduction, Architecture, Application: A case study on image captioning or sentiment analysis, or translation Attention Network: Introduction, Attention mechanism, Types of Attention, Architecture, Application: A case study on the addition of attention layer in Encoder/Decoder	15 Hours	1

Suggested Readings:

1. Goodfellow, Benjio Corivilli, “Deep Learning”, Mit Press 2016.
2. Bishop, “Pattern Recognition And Machine Learning”, Springer 2009.
3. Chollet, “Deep Learning With Python”, Manning Publications, 2017.

MCADS1334: Natural Language Processing

Course Objective:

1. Natural language processing deals with written text.
2. Students will learn how to process written text from basic of fundamental knowledge starts with Finite automata, Regular expression and probabilistic model with n-grams.
3. Recognizing Speech and parsing with grammar.

Learning Outcome: On completion of this course students will be able to

1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatic
4. To Introduce Speech Production And Related Parameters Of Speech.
5. To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.

Course Contents:

Module	Course Topics	Total	Credits
I	INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance WORD LEVEL ANALYSIS : Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.	15 Hours	1
II	SYNTACTIC ANALYSIS: Context Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures	15 Hours	1
III	SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary	15 Hours	1

	& Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.		
IV	BASIC CONCEPTS of Speech Processing: Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods. SPEECH-ANALYSIS: Features, Feature Extraction And Pattern Comparison Techniques: introduction to Speech Distortion Measures– Mathematical And Perceptual method. SPEECH MODELING: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	15 Hours	1

Suggested Readings:

1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, OReilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, “Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition”, Pearson Education, 2002.
5. Frederick Jelinek, “Statistical Methods Of Speech Recognition”, MIT Press, 1997.

MCADS1311: Business Intelligence

COURSE OBJECTIVE:

- 1 Be exposed with the basic rudiments of business intelligence system
- 2 understand the modeling aspects behind Business Intelligence
- 3 understand of the business intelligence life cycle and the techniques used in it
- 4 Be exposed with different data analysis tools and techniques

LEARNING OUTCOME: At the end of the course the students will be able to

- 1 Explain the fundamentals of business intelligence.
- 2 Link data mining with business intelligence.
- 3 Apply various modeling techniques.
- 4 Explain the data analysis and knowledge delivery stages.
- 5 Apply business intelligence methods to various situations.
- 6 Decide on appropriate technique.

COURSE CONTENTS:

Unit	Details	Hours	Credit
I	Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system	15 Hours	1
II	Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data, Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction	15 Hours	1
III	Business intelligence applications: Relational marketing, Sales force management New BI Application Opportunities, Reality Mining Virtual Worlds, The Web 2.0 Revolution, Virtual Communities, Online Social Networking: Basics Examples; Cloud Computing and BI, The Impacts of management Support Systems-An Overview, Management Support Systems Impacts on Organizations	15 Hours	1

IV	Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management.	15 Hours	1
-----------	--	----------	---

Suggested Readings:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision support and Business Intelligence Systems", 9th volume 2011, Pearson Publication
2. Carlo Verzellis, "Business Intelligence: Data Mining and Optimization for Decision Making", 1st Volume 2009, Wiley Publication
3. Grossmann W, Rinderle-Ma, "Fundamental of Business Intelligence", 1st Volume 2015, Springer

MCADS1312: Cryptography and Network Security

Course Objective:

4. To understand Cryptography Theories, Algorithms and Systems.
5. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
6. To highlight the features of different technologies involved in Network Security.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

5. Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
6. Ability to identify information system requirements for both of them such as client and server.
7. Ability to understand the current legal issues towards information security.

Course Contents:

Module	Course Topics	Hours	Credits
I	Conventional Encryption Techniques: Conventional Encryption Models, Modern Technique, Algorithms, DES, IDE, RC5, CAST, RC2, And Confidentiality Using Conventional Encryption	15 Hours	1
II	Public Key Cryptography: Principles of Public Key Crpto-systems, RSA Alorithms, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography	15 Hours	1
III	Network Security: Kerberos, X.509 Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy, S/MIME, IP Security, IP Security Architecture, Authentication Header, Encapsulating Security Payload, web Security	15 Hours	1
IV	System Security: Introduction to System Security, Aspect of System Security, Need and Goal of System Security, Feature of Good Security, Intruder, Viruses, and Worms, Firewalls, Firewalls Design Principles, Trusted Systems	15 Hours	1

Suggested Readings:

1. William Stallings, Computer Security, "Principles and Practices", Pearson 6 Ed, ISBN 978-0-13-335469-0 2.
2. Bruce Schneier, "Applied Cryptography- Protocols, Algorithms and Source code in C Algorithms", Wiely India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0. 3.
3. CK Shyamala et el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9.
4. Berouz Forouzan, "Cryptography and Network Security", TMH, 2 edition, ISBN -978-00-707-0208-0. 5.
5. Mark Merkow, "Information Security-Principles and Practices", Pearson Ed., ISBN- 978-81-317-1288-7.

MCADS1313: Cloud Computing

Course Objectives:

1. To provide skills and knowledge in cloud technology operations and management in order to implement large-scale systems.
2. To provide expertise in the creation of appropriate cloud infrastructure that fulfills the needs of business services and customers.

Learning Outcome:

1. To examine existing cloud infrastructures and determine an acceptable architecture that fulfills business goals.
2. Interpret alternative service delivery and deployment methods to find a model that best fits the company needs.
3. Identify cloud computing security and privacy risks and develop appropriate security solutions to secure cloud resources.

Course Contents:

Module	Course Topics	Hours	Credits
I	Basic Concepts of Cloud Computing: Understanding Cloud Computing: Clustering, Grid Computing, Virtualization, Cloud, Cloud Goals and Benefits, Cloud Risks and Challenges; Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Services Models, Cloud Deployment Models; Cloud- Enabling Technology: Broadband Networks, Internet Architecture, Data Center Technology, Virtualization Technology; Fundamental Cloud Security: Confidentiality, Integrity, Authenticity, Availability, Threat, Vulnerability, Risk, Cloud Security Threats.	15 Hours	1
II	Cloud Computing Architecture: Fundamental Cloud Architectures: Workload Distribution, Resource Pooling, Dynamic Scalability, Elastic Resource Capacity, Service Load Balancing, Cloud Bursting, Elastic Disk Provisioning, Redundant Storage; Advanced Cloud Architectures: Hypervisor Clustering, Load Balanced Virtual Server Instances, Non-Disruptive Service Relocation, Zero Downtime, Cloud Balancing, Resource Reservation, Dynamic Failure Detection and Recovery, Bare-Metal Provisioning, Rapid Provisioning, Storage Workload Management; Specialized Cloud Architectures: Direct I/O Access, Direct LUN Access, Dynamic Data Normalization, Elastic Network Capacity, Cross-Storage Device, Intra-Storage Device, Vertical Data Tiering, Load Balanced Virtual Switches, Multipath Resource Access, Persistent Virtual Network Configuration, Redundant Virtual Servers, Storage Maintenance Window.	15 Hours	1

III	Cloud Management Mechanisms: Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication; Specialized Cloud Mechanisms: Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi-Device Broker, State Management Database; Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.	15 Hours	1
IV	Cloud Security and Clouds Cost Metrics: Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Cloud-Based Security Groups, Hardened Virtual Server Images; Cloud Delivery Model Considerations: Cloud Provider Perspective, Cloud Consumer Perspective; Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage Cost Metrics, Cost Management Considerations; Service Quality Metrics.	15 Hours	1

Suggested Readings:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", 1st edition, Pearson, 2019.
2. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing", Black Book, dreamtech, 2015.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 1st Edition, O'Reilly Media, 2009.
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
5. Tim Malhar, S. Kumaraswamy, "Cloud Security & Privacy", S.Latif (SPD, O'REILLY).
6. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge University Press, 2010.
7. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter "Cloud Computing, A Practical Approach", Tata McGraw Hill Education Publication (TMH Publication), 2009.

MCADS1314: Internet of Things

Course Objective

1. Understand the basics of Embedded System, IoT and the development model.
2. Understand the architecture, Instruction set and work on an 8-bit microcontroller using simulation and real-time.
3. Ability to select appropriate hardware and microcontrollers based on need of application
4. Understand the Internet of Things Standards, Frameworks and techniques.
5. Apply the tools, techniques and skills acquired towards development of Projects.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Assess the vision and introduction of IoT.
2. Understand IoT Market perspective.
3. Implement Data and Knowledge Management and use of Devices in IoT Technology.
4. Classify Real World IoT Design Constraints, Industrial Automation in IoT.

Course Contents:

Module	Course Topics	Hours	Credits
I	Internet of Things (IoT), Design Principles for Connected Devices: Introduction to IoT, Basics of Networking, Communication Protocols, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, Sensor Networks, Machine-to-Machine Communications, IoT Examples, IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation.	15 Hours	1
II	Technologies Standard and Hardware: Introduction, Sensors, digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology, Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	15 Hours	1
III	Network & Communication Aspects in IoT, Case Studies, Cloud Computing: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring. Introduction of Cloud Computing.	15 Hours	1
IV	Challenges in IoT Design Challenges, IoT Applications: Development challenges, Security challenges, Other challenges, Smart metering, e-health, Smart city, automotive applications, home automation, smart cards, Communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	15 Hours	1

Suggested Readings:

1. Embedded Real Time Systems: Concepts, Design and Programming by Dr.K.V.K.K. Prasad, DreamTech Publication, 2003.
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C 2/e by Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, Pearson Education, 2011.
3. Designing the Internet of Things by Adrian McEwen, Hakim Cassimally, Wiley Publications, 2012
4. The Internet of Things: Key applications and Protocols by Wiley Publications 2nd Edition

MCADS1351: Client Side Scripting Lab

Module	Course Topics	Credits
I	<ol style="list-style-type: none">1. Develop program using basic features of JavaScript to solve the given problem2. Develop JavaScript to implement the switch-case statement for the given problem.3. Develop JavaScript to implement loop for solving the given iterative problem.4. Develop JavaScript to implement the given function.5. Perform the specified string manipulation operation on the given String(s).6. Write JavaScript to design a form to accept input values for the given problem.7. Use JavaScript to implement form events to solve the given problem.8. Develop JavaScript to dynamically assign specified attribute value to the given form control	1
II	<ol style="list-style-type: none">1. Create cookies based on the given problem.2. Develop JavaScript to manage a cookie in the given manner.3. Write JavaScript to manipulate the specified attributes of window object in the given manner.4. Develop JavaScript to manage the given status bar.5. Develop JavaScript to create the given Menu.6. Develop rollover, text rollover, Multiple actions for rollover, more efficient rollover.	1

MCADS1352: Mini Project

MCADS1401: Machine Learning

Note: Syllabus Provided by IBM

Course Objective:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.
4. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
2. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
3. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
4. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques

Course Contents:

Module	Course Topics	Hours	Credits
I	INTRODUCTION TO MACHINE LEARNING: Application of Machine Learning, Supervised vs Unsupervised Learning, Python libraries suitable for Machine Learning PYTHON FOR MACHINE LEARNING: Intro to Numpy, Joining Numpy Arrays, Numpy Intersection & Difference, Numpy Array Mathematics, Saving and Loading Numpy Array; Intro to pandas, Pandas Series Object, Pandas DataFrame Object, Pandas Functions; Data visualization using Matplotlib and Seaborn library: bar graph, line graph, histogram, pie chart, scatter graph; Data Pre-processing and Data Scaling Methods: Identifying and handling the missing values, Encoding the categorical data, Normalization, Standardization	15 Hours	1
II	DATA PRE-PROCESSING AND DATA: Identifying and handling the missing values using fillna() function and SimpleImputer library of sklearn Encoding the categorical data, Normalization, Standardization, PCA	15 Hours	1

III	SUPERVISED LEARNING REGRESSION AND CLASSIFICATION: Regression Algorithms: Linear Regression, Decision Tree Regressor, Random Forest Regressor, SVR: Support Vector Regressor, Time Series Problem; Model evaluation methods: mean absolute error, square mean error, RMSE value; Classification Algorithms: Logistic Regression, Decision tree classifier, Random Forest classifier, SVM, Naïve bayes: Gaussian NB, Multinomial NB, Bernoulli's NB; Model evaluation methods: accuracy score, Precision, recall, F1 -score.	15 Hours	1
IV	Unsupervised Learning: Clustering Algorithm: K-means Clustering (Elbow and purpose method), Hierarchical Clustering; Dimension Reduction: PCA; Feature Scaling: MinMaxScaler, Standard Scaler	15 Hours	1

Suggested Readings:

1. Machine Learning - Tom M. Mitchell
2. Python Machine Learning – Sebastian, Raschka and Vahid Mirjalili
3. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Technique to Build Intelligent Systems - Aurélien Géron
4. Understanding Machine Learning - Shai Shalev-Shwartz and Shai Ben-David La

MCADS1403: Pattern Recognition

Course Objective:

1. Learn about pattern recognition and its broad applications in various aspects of our day to day life.
2. Understand the algorithms used in various phases of pattern recognition systems, including data acquisition, pre-processing, segmentation, feature extraction and classification.
3. Understand the techniques used recognize patterns, such as statistical approaches, data clustering, neural networks, etc.
4. Knowledge of various applications of pattern recognition in real life, this includes reading research papers and preparing presentations by the students.

Learning Outcome: Upon successful completion of the course the student will:

1. Define the meaning of intelligence and study various intelligent agents.
2. Understand, analyze and apply AI searching algorithms in different problem domains.
3. Study and analyze various models for knowledge representation.
4. Understand the basic concepts of machine learning to analyze and implement widely used.

Course Contents:

Module	Course Topics	Hours	Credits
I	INTRODUCTION: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches. Statistical Patten Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminates functions	15 Hours	1
II	Nonparametric Techniques: Density Estimation, Parzen Windows, K- Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification. Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation- maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models	15 Hours	1

Suggested Readings:

1. Duda R. O., Hart P. E. and Stork D. G., "Pattern Classification", John Wiley.
2. Bishop C. M., "Neural Network for Pattern Recognition", Oxford University Press.
3. Singhal R., "Pattern Recognition: Technologies & Applications", Oxford University Press.
4. Theodoridis S. and Koutroumbas K., "Pattern Recognition", Academic Press.