

## Business Intelligence and Big Data Analytics

Sr. No.	Modules/Units	No of Hour
1	<b>Overview of Business Intelligence, Analytics, and Data Science</b>	15
2	<b>Hadoop and Map Reduce</b>	15
3	<b>YARN, PIG and OOZIE</b>	15
4	<b>Data Management and Data Analytics</b>	15
<b>Total</b>		60

### Course Objective:

- 1) Exposure to the fundamentals of business intelligence and big data analytics.
- 2) Analyze data to generate information and knowledge that lead to informed decisions for businesses.
- 3) Data, Text, and Web Mining in the context of Big Data and Business Applications to Big Data Analytics Applications for Business Intelligence.
- 4) Understand basic concepts in Big Data analytics and parallel data processing

### Learning Outcomes:

- 1) Explain big data and the technologies associated with it.
- 2) Identify Big Data and its Business Implications.
- 3) List the components of Hadoop and Hadoop Eco-System

#### Unit I:

**An Overview of Business Intelligence, Analytics, and Data Science:** Big Data, importance of Big Data, Structuring Big data, Elements of Big Data, Big Data Analytics, Exploring the use of Big Data in Business: Big data in Social Networking, Preventing Fraudulent Activities.

**Technologies for handling Big data:** Distributed and parallel computing, Introducing Hadoop, Cloud computing and Big Data, In-memory computing Technology for Big data

#### Unit II:

**Hadoop Ecosystem:** Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, Zookeeper, Flume, Oozie

**MapReduce Fundamentals and HBase:** The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing

**Processing Data with MapReduce:** Recollecting the Concept of MapReduce Framework, Developing Simple MapReduce Application, Points to Consider while Designing MapReduce

#### Unit III:

**Understanding Hadoop YARN Architecture:** Background, advantages, Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, YARN Commands, YARN Containers and Registry.

**Analyzing data with Pig:** Introducing Pig, Running Pig, Getting Started with Pig Latin, Working with Operators in Pig, Debugging Pig, Working with Functions in Pig, Error Handling in Pig

**Using Oozie:** Introducing Oozie, Installing and Configuring Oozie, Understanding the Oozie Workflow, Oozie Coordinator, Oozie Bundle, Oozie Parameterization with EL, Oozie Job Execution Model, Accessing Oozie, Oozie SLA

#### Unit IV:

**NoSQL Data Management:** Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding, Streaming data.

**Data Movement with Flume and Sqoop:** Flume Architecture, Sqoop, Importing Data, Sqoop2 vs Sqoop.

**Understanding Analytics and Big Data:** Comparing Reporting and Analysis, Types of Analytics.

**Analytical Approaches and Tools to Analyze Data:** Analytical Approaches, History of Analytical Tools, Introducing Popular Analytical Tools, Comparing Various Analytical Tools

**Teaching & Learning Process-****Assessment Method-**

Class participation, Presentation, Practical, Viva/ test, End Semester Exam

**References Books –**

1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization, Dreamtech Press; 1st edition, 2016
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series, 2013
3. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill, 2012
4. Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results, Wiley, 1st edition, 2016
5. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Michael Minelli, Wiley, 2013

**PRACTICAL COMPONENT**

<b>Sr. No</b>	<b>Module</b>
1	Working with Apache Hadoop
2	Working with Single-Node Hadoop configuration on the system
3	Exploring the Web-Based User Interface of Hadoop Cluster
4	Implementing Map-Reduce Program for Word Count
5	Implementing Map-Reduce Program for count
6	Implementing Basic Pig Latin Script File
7	Implementing Basic Hive Query Language Operations File
8	Working with NoSQL Data.
9	Using Apache Flume to fetch open-source user tweets from Twitter File

## Cloud Computing

Sr. No.	Modules/Units	No of Hour
1	<b>Fundamentals of Cloud Computing</b>	15
2	<b>Cloud Types, Models and Techniques</b>	15
3	<b>Security in Cloud</b>	15
4	<b>Administration for Cloud</b>	15
<b>Total</b>		60

**Course Objective:** At the end of **Cloud Computing course**, the students will:

- 1) Have an insight into the basics of cloud computing along with virtualization.
- 2) Have a conceptual understanding of cloud computing and will be in the position to assess their application objectives and decide how to deploy their application in the cloud with ease.
- 3) Understand the security aspects in cloud.

**Learning Outcomes:**

- 1) Student will have basic understanding about cloud and virtualization along with it how one can migrate over it.
- 2) Students can identify the various levels of services that can be achieved by cloud
- 3) Student can understand the issues related to Cloud Computing.
- 4) Students will recognize the administrative challenges in Cloud Computing.

<b>Unit I:</b>
<b>Fundamentals of Cloud Computing</b> Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. Cloud Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models <b>Principles of Parallel and Distributed Computing:</b> Parallel and Distributed Computing. Technologies for Distributed Computing. <b>Introduction to Virtualization:</b> Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization, and cloud computing
<b>Unit II:</b>
<b>Cloud Types and Models:</b> <b>Open-Source Cloud Implementation and Administration:</b> <b>Cloud Deployment Techniques:</b>
<b>Unit III:</b>
<b>Recent Trends in Cloud Computing and Standards</b> <b>Host Security in the Cloud</b> <b>Data Security in the Cloud</b> <b>Application Architecture for Cloud</b>
<b>Unit IV:</b>
<b>Risks, Consequences, and Costs for Cloud Computing</b> <b>AAA Administration for Clouds</b> <b>Regulatory and Compliance Requirements for Clouds</b> <b>Security as A Service</b>

**Teaching & Learning Process-**

**Assessment Method-**

Class participation, Presentation, Practical, Viva/ test, End Semester Exam

**Textbook(s) –**

1. Cloud Computing Black Book, Dreamtech Press, 2014
2. Mastering Cloud Computing - Technologies and Applications Programming, 2014

**References Books -**

1. Cloud Computing: Concepts, Technology & Architecture, Pearson, 2013
2. Cloud and Distributed Computing: Algorithms and Systems, Wiley

**PRACTICAL COMPONENT**

<b>Sr. No</b>	<b>Module</b>
1	Implementation of Bare-metal and hosted virtualization
2	Implementation of containerization using docker
3	Demonstration of IaaS cloud
4	Demonstration of PaaS cloud
5	Demonstration of SaaS cloud
6	Implementation of Cloud services on Open stack cloud platform
7	Implementation of Cloud services on Amazon web services
8	Demonstration of data analytics in Cloud

## Machine Learning

Sr. No.	Modules/Units	No of Hour
1	Introduction to Machine Learning	15
2	Probability and Bayesian theorem	15
3	Supervised and unsupervised Learning	15
4	Neural Network	15
<b>Total</b>		60

### Course Objective:

- 1) To introduce students to the basic concepts and techniques of Machine Learning.
- 2) To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- 3) To understand the fundamentals of deep learning.
- 4) To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.

### Learning Outcomes:

- 1) Distinguish between, supervised, unsupervised and semi-supervised learning
- 2) Apply the apt machine learning strategy for any given problem.
- 3) Suggest supervised, unsupervised, or semi-supervised learning algorithms for any given problem.
- 4) Design Systems that use the appropriate graph models of machine learning

<b>Unit I:</b>
<b>Machine learning:</b> Introduction, Types of machine learning, Applications of machine learning, Tools in machine learning <b>Preparing to model:</b> Machine learning Activities, Exploring structure of data, data Quality, data Preprocessing, <b>Modelling and Evaluation:</b> Selecting a model, training a model, Model Representation and Interpretability, Evaluating Performance of a Model <b>Basics of Feature Engineering:</b> Feature Transformation, Feature Subset Selection
<b>Unit II:</b>
<b>Brief Overview of Probability:</b> Concept of probability, Random variables, Some Common Discrete Distributions, some common Continuous Distribution, Multiple random variables. Central Limit Theorem, Sampling Distributions, Hypothesis Testing, Monte Carlo Approximation. <b>Bayesian Concept Learning:</b> Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network
<b>Unit III:</b>
<b>Supervised Learning:</b> Classification, Examples, Common Classification Algorithms- k-Nearest Neighbor (kNN), Decision tree, Random Forest model, Support vector machines <b>Supervised Learning:</b> Regression, Examples, Common Regression Algorithms- Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation

**Unsupervised Learning:** Clustering, Different types of clustering techniques - Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods – DBSCAN

**Unit IV:**

**Neural Network:** Introduction, Types of Activation Functions- Identity function, Threshold/step function, ReLU (Rectified Linear Unit) function, Sigmoid function, Hyperbolic tangent function.

**Architectures of Neural Network:** Single-layer feed forward network, multi-layer feed forward ANNs, Competitive network, Recurrent network,

**Learning Process in ANN:** Number of layers, Direction of signal flow, Number of nodes in layers, Weight of interconnection between neurons, Backpropagation, Deep Learning

**Other Types of Learning:** Representation Learning, Active Learning, Instance-Based Learning (Memory-based Learning), Ensemble Learning Algorithm

**Teaching & Learning Process-**

**Assessment Method-**

Class participation, Presentation, Practical, Viva/ test, End Semester Exam

**Textbook(s)-**

1. Machine Learning Pearson, 2018
2. Machine Learning Paperback, McGraw Hill, 1st edition, 2017

**References Books –**

1. Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning series), MIT Press, 2012
2. Neural Networks and Deep Learning: A Textbook, Springer, 1st edition, 2018

**PRACTICAL COMPONENT**

Sr. No	Module
1	Implementing Hypothesis Testing
2	Implementing Monte Carlo Approximation.
3	Implementing Bays Theorem.
4	Implementing Supervised Learning a. k-Nearest Neighbor (kNN), b. Decision tree, c. Random forest model, d. Support vector machines
5	Implementing Unsupervised Learning a. K-Medoids: b. Hierarchical clustering,
6	Model Based Predictions - Comparing Supervised learning models: Prediction, Errors, and Cross Validation
7	Implementing Neural network.
8	Implementing Ensemble Learning Algorithm

## Security Attacks and countermeasures

Sr. No.	Modules/Units	No of Hour
1	<b>Information Security Attacks</b>	15
2	<b>Network Sniffing and Social Engineering Attacks</b>	15
3	<b>Session high jacking and Attacking Web Servers</b>	15
4	<b>SQL Injection, Cloud Security and Cryptography</b>	15
<b>Total</b>		60

### Course Objective:

- 1) To develop a lifelong passion and appreciation for cyber **security**, which we are certain will help in future endeavors.
- 2) To describe malicious code and the various countermeasures
- 3) To describe the processes for operating endpoint device security and configuring cloud security.

### Learning Outcomes:

- 1) Student will have a baseline understanding of common cyber security threats, vulnerabilities, and risks.
- 2) Student can Identify malicious code activity.
- 3) Student will have a knowledge of cyber **security** threats and **attacks**.
- 4) Student will understand the process for configuring cloud security

<b>Unit I:</b>
<b>Information Security Attacks:</b> Introduction to Information Security, Threats and Attack vectors, Hacking and its Types, Steps in Hacking, Information Security Controls, concept of Vulnerability assessment & Penetration Testing <b>Foot printing, Scanning and Enumeration:</b> Foot printing, scanning methods, scanning beyond IDS and firewalls, Tools, Banner Grabbing, Scanning Techniques, Network Diagrams and mapping, penetration testing. Different types of enumeration: NetBIOS, SNMP, LDAP, NTP, SMTP, DNS, other enumeration techniques, Countermeasures, Penetration Testing <b>Breaching System Security:</b> Cracking passwords, escalating privileges, Executing Applications, hiding files, covering tracks, countermeasures
<b>Unit II:</b>
<b>Malware Threats:</b> Concepts, Malware Analysis, Trojan concepts, countermeasures, Virus and worm concepts, anti-malware software, countermeasures <b>Network Sniffing:</b> Concepts, sniffing techniques, detection techniques and tools, countermeasures <b>Social Engineering Attacks:</b> Impersonation on networking sites, Techniques, Identity theft, Insider threats, countermeasures <b>Denial of Service and Distributed Denial of service:</b> Techniques, botnets, attack tools, countermeasures, protection tools, countermeasures
<b>Unit III:</b>
<b>Active Session High jacking:</b> Tools, application-level session hijacking, countermeasures, network level session hijacking <b>Evading IDS, Firewalls and Honeypots:</b> Concepts, detecting honeypots, evading IDS, IDS and Firewall evasion countermeasures, evading firewalls, penetration testing. <b>Attacking Web Servers and Web Applications:</b> Concepts, attacks, attack methodology, attack tools, countermeasures, patch management, web server security tools, penetration testing.
<b>Unit IV:</b>

**SQL Injection Attack:** Concepts, types and methodology, tool and techniques, countermeasures.

**Compromising Wireless and Mobile Networks:** Concepts, wireless encryption, threats, methodology, Attack vectors, tools, compromising Bluetooth, countermeasures, wireless security tools, Mobile spyware, penetration testing.

**Cloud Security:** Concepts, Security, threats, attacks, tools, penetration testing.

**Cryptography:** Concepts, email encryption, algorithms, disk encryption, tools, cryptanalysis, public key infrastructure, countermeasures.

### Teaching & Learning Process-

### Assessment Method-

Class participation, Presentation, Practical, Viva/ test, End Semester Exam

### Textbook: -

1. CEHv10, Certified Ethical Hacker Study Guide, Ric Messier, Sybex - Wiley, 2019
2. All in One, Certified Ethical Hacker, Matt Walker, Tata McGraw Hill, 2012

### References Books –

1. CEH V10: EC-Council Certified Ethical Hacker Complete Training Guide, I.P. Specialist, PSPECIALIST, 2018

### PRACTICAL COMPONENT (1 Credit)

Sr. No	Module
1	Gathering Information about target Computer Systems - Foot printing and Investigation
2	Scanning computers in network
3	Enumerating users and connecting them
4	Monitoring and Capturing Data Packets using Sniffing
5	Injecting Code in Data Driven Applications: SQL Injection
6	Encrypting and decrypting the code – Cryptography and Hashing
7	Restricting the System Access – Denial of Service (DoS Attack)
8	Wireless networks and threats associated with it
9	Restricting the System Access – Denial of Service (DoS Attack) File
10	Protect the Web Application