Business Intelligence and Big Data Analytics

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

Sr. No	Module
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	**Fundamentals of Cloud Computing**	15
2	**Cloud Types, Models and Techniques**	15
3	**Security in Cloud**	15
4	**Administration for Cloud**	15
Total		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.

Unit I:
Fundamentals of Cloud Computing   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   **Principles of Parallel and Distributed Computing:** Parallel and Distributed Computing. Technologies for Distributed Computing.   **Introduction to Virtualization:** Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization, and cloud computing
Unit II:
Cloud Types and Models: **Open-Source Cloud Implementation and Administration:**   **Cloud Deployment Techniques:**
Unit III:
Recent Trends in Cloud Computing and Standards   **Host Security in the Cloud**   **Data Security in the Cloud**   **Application Architecture for Cloud**
Unit IV:
Risks, Consequences, and Costs for Cloud Computing   **AAA Administration for Clouds**   **Regulatory and Compliance Requirements for Clouds**   **Security as A Service**

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

Sr. No	Module
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
Total		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

Unit I:
Machine learning: Introduction, Types of machine learning, Applications of machine learning, Tools in machine learning   **Preparing to model:** Machine learning Activities, Exploring structure of data, data Quality, data Preprocessing,   **Modelling and Evaluation:** Selecting a model, training a model, Model Representation and Interpretability, Evaluating Performance of a Model   **Basics of Feature Engineering:** Feature Transformation, Feature Subset Selection
Unit II:
Brief Overview of Probability: 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.   **Bayesian Concept Learning:** Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network
Unit III:
Supervised Learning: Classification, Examples, Common Classification Algorithms- k-Nearest Neighbor (kNN), Decision tree, Random Forest model, Support vector machines   **Supervised Learning**: 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	**Information Security Attacks**	15
2	**Network Sniffing and Social Engineering Attacks**	15
3	**Session high jacking and Attacking Web Servers**	15
4	**SQL Injection, Cloud Security and Cryptography**	15
Total		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

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

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