RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.Tech.) DEGREE COURSE
SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Data Science **Subject code:** BTECH_CSEDS-601T

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	Building the fundamentals of data science.
2	Gaining practical experience in programming tools for data sciences
3	Empowering students with tools and techniques used in data science

Course Outcome:

At the end of this course students are able to:

CO1	Apply toolboxes in Data Science.
CO2	Understand statistics, measure, learn Inference frequency Approach
CO3	Utilize Learning models.
CO4	To learn and understand various regression testing methods.
CO5	To analyze and apply network using data science

Unit 1	Introduction: Objective, scope Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and ploting. **7Hrs**
Unit 2	Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values. **8Hrs**
Unit 3	Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. **7Hrs**
Unit 4	Regression analysis, Regression: linear regression simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study. **7Hrs**
Unit 5	Network Analysis, Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection. **7Hrs**

Text Books-

1. Data Science from Scratch- Joel Grus
2. Introduction To Data Structures With Applications 2Nd Edition by Jean-Paul Tremblay Paul Sorenson , McGraw Hill Education India Pvt Ltd
3. Data Science for Business- Tom Fawcett

Reference Books:

1. Designing Data-Intensive Applications -Martin Kleppmann
2. Data Science and Big Data Analytics- EMC Education Services
3. The Data Science Handbook- Field Cady

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SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Machine Learning **Subject code:** BTECH_CSEDS-602T

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	1	4	30	70	100

Course Objectives:

1	To understand the need for machine learning for various problem solving
2	To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
3	To understand the latest trends in machine learning

Course Outcome:
At the end of this course students are able to:

CO1	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
CO2	Discuss the decision tree algorithm and identity and overcome the problem of over fitting
CO3	Discuss and apply the back propagation algorithm and genetic algorithms to various problems
CO4	Apply the Bayesian concepts to machine learning
CO5	Analyse and suggest appropriate machine learning approaches for various types of problems

Unit 1	Introduction : Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **7Hrs**
Unit 2	Neural Networks And Genetic Algorithms Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning. **8Hrs**
Unit 3	Bayesian and Computational Learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **7Hrs**
Unit 4	Instant Based Learning K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. **7Hrs**
Unit 5	Advanced Learning Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **7Hrs**

Text Books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Reference Books:

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, ―Machine learning: An Algorithmic Perspective, CRC Press, 2009.

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SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Principles of Cloud Computing **Subject Code:** BTECH_CSEDS-603.1T

Elective-II

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs (Theory)	3	-	3	30	70	100

Course Objective:

1	This course provides an insight into cloud computing
2	Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

Course Outcome:

At the end of this course students are able to:

CO1	Articulate the main concepts, key technologies, strengths, limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
CO2	Identify the architecture and infrastructure of cloud computing, including cloud delivery and deployment models.
CO3	Analyze the core issues of cloud computing such as security, privacy, and interoperability.
CO4	Identify problems, analyze, and evaluate various cloud computing solutions.
CO5	Analyze appropriate cloud computing solutions and recommendations according to the applications used.

Unit 1	Cloud Computing fundamentals: Essential characteristics, Architectural Influences, Technological Influences, and Operational Influences. **7Hrs**
Unit 2	Cloud Computing Architecture: Cloud Delivery models, The SPI Framework, Cloud Software as a Service (SaaS) , Cloud Platform as a Service(PaaS), Cloud Infrastructure as a Service(IaaS), Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Alternative Deployment models, Expected benefits. **8Hrs**
Unit 3	Cloud Computing Software Security fundamentals: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering, Cloud Security Policy Implementation. **7Hrs**
Unit 4	**Cloud Computing Risk Issues:** The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks. **Cloud Computing Security challenges:** Security Policy Implementation, Policy Types, and Computer Security Incident Response Team (CSIRT) **7Hrs**

Unit 5	Cloud Computing Security Architecture: Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Micro architectures, Identity Management and Access Control, Autonomic Security **7Hrs**

Text Books-

1. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A comprehensive Guide to secure Cloud Computing" Wiley.
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference Books:

1. John W. itinghouse james F.Ransome, "Cloud Computing Implementation, Management and Security" , CRC Press.
2. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer
3. Charles Badcock, "Cloud Revolution" , TMH

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BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Elective – II Computer Vision **Subject Code:** BTECH_CSEDS-603.2T

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs (Theory)	3	-	3	30	70	100

Course Objective:

1	Student shall be able to understand the Computer Vision & Image analysis.
2	Student shall be able to understand the Image Formation Models.
3	Student shall be able to understand the Object Recognition and Tracking.
4	Student shall be able to understand the Visual surveillance.

Course Outcome:

At the end of this course students are able to:

CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
CO2	Discriminate the basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.
CO3	Analyze and demonstrate various image segmentation techniques.
CO4	Distinguish the methods to use for solving a given problem, and analyze the accuracy
CO5	Utilize the techniques, skills and modern computer Engineering tools, Software and techniques necessary for Engineering practice.

Unit 1	**Introduction:** Purpose of computer vision, State-of-the-art, history of computer vision, some typical applications of computer vision in surveillance, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis. **7Hrs.**
Unit 2	**Image Formation Models:** Monocular imaging system, orthographic & perspective projection, camera model and camera calibration, binocular imaging systems, Image Processing and Feature Extraction, Image representations color representations, edge detection, some important texture representation, Motion Estimation, Regularization theory, optical flow computation, stereo vision, motion estimation, structure from motion. **8Hrs.**
Unit 3	**Object Recognition and Tracking:** Shape representation, shape descriptors, object localization, object representation using low level and high level features; Object Tracking: Basics of object tracking, single object tracking, multiple object tracking, slow moving and fast moving objects and related algorithms, object trajectory analysis **7Hrs.**

Unit 4	**Visual Surveillance:** Basics of surveillance, single camera based surveillance, multiple camera guided surveillance, surveillance using moving camera, public place surveillance, health care surveillance. **7Hrs.**
Unit 5	**3D Vision:** Projective geometry, single perspective camera, stereopsis, the fundamental matrix –its estimation from image point correspondences, applications of epipolargeometry in vision, correlation based and feature based stereo correspondence, shape from motion, optical flow. **7Hrs.**

Text Books-

1. Computer Vision -A Modern Approach by D. A. Forsyth and J. Ponce, Pearson, 2nd edition, 2012

2. Schalkoff, John Wiley and Sons, "Digital Image Processing &Computer Vision", 1989, John Wiley and Sons.

Reference Books:

1. Sonka, Hlavac and Boyle Brooks/Cole, "Image Processing, Analysis, and Machine Vision", 1999, Thomson Asia Pte Ltd Singapore

2. Jain and Rangachar, "Machine Vision", 1999, McGraw Hill International Edition.

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SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Elective – II Design Pattern **Subject Code:** BTECH_CSEDS-603.3T

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs (Theory)	3	-	3	30	70	100

Course Objective:

1	Understand the concept of Design patterns and its importance.
2	Understand the behavioral knowledge of the problem and solutions.
3	Relate the Creational, Structural, behavioral Design patterns.
4	Apply the suitable design patterns to refine the basic design for given context.
5	Implement a module so that it executes efficiently and correctly.

Course Outcome:

At the end of this course students are able to:

CO1	Construct a design consisting of a collection of modules.
CO2	Exploit well-known design patterns (such as Iterator, Observer, Factory and Visitor)
CO3	Distinguish between different categories of design patterns.
CO4	Ability to understand and apply common design patterns to incremental/iterative development.
CO5	Ability to identify appropriate patterns for design of given problem

Unit 1	**Introduction:** What is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalogue of Design Patterns, Organizing The Cato log, How Design Patterns solve Design Problems, How to Select a Design pattern, How to Use a Design Pattern. **8Hrs**
Unit 2	A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation. **7Hrs**
Unit 3	Structural Pattern Part-I, Adapter, Bridge, Composite. Structural Pattern Part-II, Decorator, Facade, Flyweight, Proxy. **7Hrs**
Unit 4	Behavioral Patterns Part: I, Chain of Responsibility, Command, Interpreter, Iterator. Behavioral Patterns Part: II, Mediator, Memento, Observer, Discussion of Behavioral Patterns **7Hrs**
Unit 5	Behavioral Patterns Part: III, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community, An Invitation, A Parting Thought **7Hrs**

Text Books-

1. Design Patterns By Erich Gamma, Pearson Education
2. Design Patterns Explained By Alan Shalloway,Pearson Education
3. Meta Patterns designed by Wolf gang , Pearson.

Reference Books:

1. JAVA Enterprise Design Patterns Vol-III By Mark Grand ,Wiley DreamTech
2. Pattern"s in JAVA Vol-I By Mark Grand ,Wiley DreamTech.
3. Pattern"s in JAVA Vol-II By Mark Grand ,Wiley DreamTech

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BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Advance Operating system **Subject Code:** BTECH_CSEDS-604.1T

Elective-III

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	To get a comprehensive knowledge of the architecture of distributed systems.
2	To understand the deadlock and shared memory issues and their solutions in distributed environments.
3	To know the security issues and protection mechanisms for distributed environments.

Course Outcome:

At the end of this course students are able to:

CO1	Reviewing the basic concepts of Advance operating systems.
CO2	Learning more advanced concepts of operating systems, including computer networks and distributed deadlock detection.
CO3	Defining the concept of distributed shared memory
CO4	Understand the concept of database operating system
CO5	Understanding the unique design requirements of microprocessor operating systems including the interconnected network.

Unit 1	Architecture of Distributed Systems, System Architecture types, Issues in distributed operating systems, Communication networks, Communication primitives. Theoretical Foundations - inherent limitations of a distributed .Distributed Mutual Exclusion, Introduction. The classification of mutual exclusion and associated algorithms. **8Hrs**
Unit 2	Distributed Deadlock Detection, Introduction, Deadlock handling strategies in distributed systems, Issues in deadlock detection and resolution, Control organizations for distributed deadlock detection, Centralized and distributed deadlock detection algorithms .Distributed resource management: introduction, Architecture, Mechanism for building distributed file systems. **7Hrs**
Unit 3	Distributed shared memory, Architecture, Algorithms for implementing DSM, Memory coherence and protocols, Design issues. Distributed Scheduling, Introduction, Issues in load distributing, Components of a load distributing. Failure Recovery and Fault tolerance: Introduction, Basic Concepts classification of failures, backward and forward error recovery. **7Hrs**
Unit 4	Database Operating systems :Introduction- requirements of a database operating system Concurrency control : Theoretical aspects, Introduction, database systems ,a concurrency control model of database systems, The problem of concurrency control – serializability theory-distributed database systems, Introduction, basic synchronization primitives **7Hrs**
Unit 5	Multiprocessor operating systems, Basic multiprocessor system architectures, Inter connection networks for multiprocessor systems, Caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system. **7Hrs**

TEXT BOOK:

1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001
2. Corbato, A. (1968). Paging Experiment with the Multics System. MIT Project MAC Report, MAC-M-384.

REFERENCES

1. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003
2. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003.

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BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Advance Computer Network **Subject Code:** BTECH_CSEDS-604.2T

Elective-III

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	Understand the basic layers and its functions in computer networks.
2	Design protocols for various functions in the network..
3	Understand the working of various application layer protocols.

Course Outcome:

At the end of this course students are able to:

CO1	Understand the protocol layering and physical level communication.
CO2	Analyze the performance of a network.
CO3	Understand the various components required to build different networks.
CO4	Learn the functions of network layer and the various routing protocols.
CO5	To familiarize the functions and protocols of the Transport layer.

Unit 1	Networks – Network Types ,Protocol Layering ,TCP/IP Protocol suite ,OSI Model ,Physical Layer: Performance, Transmission media ,Switching , Circuit-switched Networks ,Packet Switching. **8Hrs**
Unit 2	Introduction – Link-Layer Addressing, DLC Services – Data-Link Layer Protocols, HDLC, PPP, Media Access Control, Wired LANs: Ethernet, Wireless LANs, Introduction, IEEE 802.11, Bluetooth, Connecting Devices. **7Hrs**
Unit 3	Network Layer Services – Packet switching, Performance, IPV4 Addresses, Forwarding of IP Packets Network Layer Protocols: IP, ICMP v4 ,Unicast Routing Algorithms, Protocols ,Multicasting Basics – IPV6 Addressing ,IPV6 Protocol. **7Hrs**
Unit 4	Introduction – Transport Layer Protocols, Services, Port Numbers, User Datagram Protocol – Transmission Control Protocol, SCTP. **7Hrs**
Unit 5	WWW and HTTP, FTP, Email, Telnet, SSH, DNS, SNMP. **7Hrs**

TEXT BOOK:

1.Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Elsevier/Morgan Kaufmann Publishers, 2013.
2.Bruce S. Davie, Adrian Farrel, "MPLS: Next Steps", Morgan Kaufmann Publishers, 2011.
William Stallings, "Foundations of Modern Networking – .

REFERENCES:

1. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", OReilly Media, August 2013.
2.Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, "Introduction to Storage Area Networks", An IBM Redbooks publication, 2018.

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SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Artificial Neural Network **Subject Code:** BTECH_CSEDS-604.3T

Elective-III

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	To develop neural network models
2	To understand the difference between biological neuron and artificial neuron
3	To understand building blocks of Neural Networks.

Course Outcome:

At the end of this course students are able to:

CO1	Reviewing the basic concepts of Artificial neural network
CO2	Learning more advanced concepts of neural network includining taxonomy of ANN
CO3	Defining the concept of Perceptron Model.
CO4	Understand the concept of Hopfield Network
CO5	Understanding the concept of Paradigms of Associative Memory

Unit 1	Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN,McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. **7Hrs**
Unit 2	Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron, Activation Function, ANN Architectures, Classification Taxonomy of ANN ,Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement),Learning Rules. **8Hrs**
Unit 3	Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model. **7Hrs**
Unit 4	Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process Identification, control, fault diagnosis. **7Hrs**
Unit 5	Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory(BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm,\BAM Energy Function. **7Hrs**

TEXT BOOK:

1 Sivanandam, S Sumathi, S N Deepa; "Introduction to Neural Networks", 2nd ed.,TATA McGraw HILL : 2005.

REFERENCES:

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004..
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
3. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.

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SEMESTER: FIFTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Open Elective-I Java Programming **Subject code:** BTECH_CSEDS-605T1

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	To teach principles of object oriented programming paradigm including abstraction, encapsulation ,inheritance and polymorphism.
2	Impart fundamentals of object oriented programming in java, including defining classes, invoking methods, using class libraries etc
3	Inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification.
4	Familiarize the concepts of packages and interfaces
5	Facilitate students in handling exceptions

Course Outcome:
At the end of this course students are able to:

CO1	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamentals concepts in OOP like encapsulation , Inheritance and polymorphism.
CO2	Design and develop java programs, analyze ,and interpret object oriented data and report results.
CO3	Design an object oriented system .AWT components and multithreaded proceeses as per needs and specifications.
CO4	It help to succeed in competitive examinations like GATE, Engineering services, Technical interviews etc
CO5	Plan their career in Java based technologies like HADOOP etc.

Unit 1	Java Basics: Review of Object oriented concepts, History of Java, JVM Architecture, Data Types ,Variables, scope and Life time variables, arrays, operators, control statements, simple java program, Static block, Static Data, Static Method, String handling and String Buffer Classes **7Hrs**
Unit 2	Object & Class: Object oriented Programming ,Class Fundamentals ,Object & Object Reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & Initialization code block, Access Control ,Modifiers ,Methods, Inner Class & Anonymous class. **7Hrs**
Unit 3	Inheritance and Polymorphism: Basic concepts, Types of inheritance, Member access rules, Usage of this and super keyword, Method Overloading , Method overriding, Abstract classes, Dynamic method dispatch ,Usage of final Keywords. PACKAGES AND INTERFACES: Defining packages, Access Protection, Importing packages ,Defining and implementing interfaces and Extending interfaces. **8Hrs**
Unit 4	INPUT AND OUTPUT AND FILE HANDLING: Concepts of streams, stream classes –Byte and Character stream, reading console Input and Writing console Output, Wrapper Classes ,File Handling .EXCEPTION HANDLING: Exception types, Usage of try, Catch, Throw ,Throws and Finally keywords, Built-in-Exceptions, Creating own Exception Classes **7Hrs**
Unit 5	MULTITHREADING: Concepts of thread, Thread Life cycle, creating threads using thread class and Runnable interface, Synchronization, Thread Properties, Inter Thread Communications. **7Hrs**

Text Books-

1. Herbert schildt(2010),The complete reference,7Th Edition ,Tata McGraw Hill, New Delhi

Reference Books:

1. Head First Java ,O'rielly publications
2. T.Budd (2009) , An Intoduction to Object Oriented Programming , 3rd Edition,Pearson Education ,India
3. J.Nino ,F.A.Hosch (2002),An Introduction to programming and OO design using java, John Wiley & sons ,New Jersey.
4. Y.Daniel Liang(2010),Introduction to Java Programming ,7th Edition ,Pearson Education India

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SEMESTER: FIFTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Open Elective I: Human Computer Interaction **Subject code:** BTECH_CSEDS-605T2

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	70	100

Course Objectives:

1	Describe what interaction design is and how it relates to human computer interaction and other fields.
2	Use, adapt and extend classic design standards, guidelines, and patterns.
3	Apply core theories, models and methodologies from the field of HCI
4	Types of Mobile Application along with Designing
5	Learn the guidelines in designing user interfaces

Course Outcome:

At the end of this course students are able to:

CO1	Understand the importance of user interface
CO2	Design effective dialog for HCI
CO3	Develop navigation panes in windows
CO4	Understand HCI using software tools, prototypes and golden rules
CO5	Analyse and apply various evaluation technique

Unit 1	Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface. **7Hrs**
Unit 2	Design process – Human interaction with computers, importance of human characteristics human consideration. Human interaction speeds, understanding business junctions. Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web , statistical graphics . **8Hrs**
Unit 3	Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. **7Hrs**
Unit 4	HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns. **7Hrs**
Unit 5	Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities. **7Hrs**

Text Books-

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech. Units 1, 2, 3
2. Human -- Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education Units 4,5

Reference Books:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

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SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Data Science Lab **Subject code:** BTECH_CSEDS-606P

Load	Practical	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Practical)	2	-	1	25	25	50

List of Practical:-

1. Interactive commands in Python, data operations, simple programs for writing into files and Reading from files. Data file manipulations programs.
2. Familiarization with IDE in Python.
3. Writing programs for standard algorithms of sorting and searching in Python.
4. Plotting the data using X-Y graph, Bar- chart, and using other plotting techniques.
5. Write programs to perform exploratory data analysis: variance, standard derivation, Summarization, distribution, and statistical inference.
6. plotting the various distributions for given data sets.
7. Classifying and presentation of data using support vector machine.
8. Write programs for k-means clustering and presentation for given data sets.
9. Write programs on graphs of social networks for community detection.
10. Write programs for analysis of graphs to find centrality and page-rank.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.E) DEGREE COURSE
SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Machine Learning-Lab **Subject code:** BTECH_CSEDS-607P

Load	Practical	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Practical)	2	1	25	25	50

Course Objectives

1	Make use of Data sets in implementing the machine learning algorithms
2	Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcome:
At the end of this course students are able to:

CO1	Understand the implementation procedures for the machine learning algorithms
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.

List of Practical:-

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.
    Select appropriate data set for your experiment and draw graphs.

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FOUR YEAR BACHELOR OF ENGINEERING (B.Tech.) DEGREE COURSE
SEMESTER: SIXTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Subject Name: Report Writing (Audit Course) **Subject Code:** BTECH_CSEDS-609A

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs (Theory)	2	NIL	NIL	50	NIL	NIL

UNIT-I	Introduction: Importance of report writing in academics and research. Various kinds of academic and research activities. Necessity of report writing for achievement of academic and research goals. Various kinds of reports / presentations. Characteristics of academic and research reports / presentations. Conclusions. ASSIGNMENTS. **7Hrs**
UNIT-II	Research paper writing Types of research papers, Structure of research papers, Research paper formats, Abstract writing, Methodology, Results and discussions, Different formats for referencing, Ways of communicating a research paper. ASSIGNMENTS. **7Hrs**
UNIT-III	Thesis writing Structure of a thesis, Scope of the work, Literature review, Experimental / computational details, Preliminary studies, Results and Discussions, Figures and Tables preparation, Conclusions and future works, Bibliography, Appendices, ASSIGNMENTS. **7Hrs**
UNIT-IV	Tools and Techniques Various word processors, e.g, MS Word, Libra-office, Latex etc. Making effective presentations using Power Point and Beamer, Uses of plagiarism detection tools. ASSIGNMENT. **7Hrs**

Reference Books:

1. A Step-by-Step Guide to Writing Academic Papers, by Anne Whitaker September 2009
2. On Writing a Thesis by C P Ravikumar.IETE Journal of Education, 2000
3. Microsoft Office 2016, by Joan Lambert and Curtis Frye, Microsoft Press, Washington98052-6399
4. LATEX for Beginners, Edition 5, March 2014 Document Reference: 3722-2014
5. Essential LATEX ++, Jon Warbrick with additions by David Carlisle, Michel Goossens, Sebastian Rahtz, Adrian Clark January 1994