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B.TECH – COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)
Course Structure R-20

SEMESTER VII

S.No.	Class	Course Code	Name of the Subject	L	T	P	C
1	PC	C87PC1	Big Data Analytics	3	0	0	3
2	PC	C87PC2	Deep Learning	3	0	0	3
3	PE	C87PE3	Professional Elective-IV 1. Storage Area Networks 2. Cyber Security 3. Mobile Application Development	3	0	0	3
4	PE	C87PE4	Professional Elective-V 1. Computer Forensics 2. Real time Data Streaming 3. Software Testing Methodologies	3	0	0	3
5	OE	C87OE5	Open Elective-II	3	0	0	3
6	PC	C87PC6	Cutting Edge Technologies Lab	0	0	2	1
7	PC	C87PC7	Big Data Analytics Lab	0	0	2	1
8	PW	C87PW8	Major Project Phase I	0	0	4	3
9	MC	MC009	Competitive exams				Satisfactory
			Total Credits				**20**

Comprehensive Viva: The Comprehensive Viva is intended to assess the students understanding of the subjects they studied during the B.Tech course of Study. The Comprehensive Viva is evaluated for 100 marks by the committee, there are no Internal marks for the Comprehensive Viva. The student should secure 50 marks to pass the exam. If any student fails in the exam he has to register as offered.

Major Project Phase I: Students can form a group of minimum of two or maximum of four under the allocated guide, students group should choose a project title, for the chosen project title carryout a detailed literature survey, problem formulation, planning higher level design. The project evaluation will be Continuous Internal Evaluation will be made by the PRC Committee. The PRC committee consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide.

Mandatory Course: Competitive Exams:
For completion of this course the student can submit the proof of appearing the competitive exams like, GATE, IELTES, GRE, TOEFL, CDAC, CDS, CAT, or any examination organized by NATIONAL TESTING AGENCY (NTA), or college in the level of NTA. (or) The student should request for the provision of conducting Technical Seminar by the department. The topic of seminar should be the current technology of respective Engineering Branch. The evaluation will be done by the Departmental Academic Committee (DAC) based on rubrics framed.

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CSE (DATA SCIENCE)

BIG DATA ANALYTICS – C87PC1

B.Tech VII Semester   **L/T/P/C**
                                                                                                                              3 /0/ 0/ 3

COURSE OBJECTIVES:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics for Business
3. To introduce the tools, technologies & programming languages which is used in day to day analytics cycle

COURSE OUTCOMES:

1. Illustrate big data challenges in different domains including social media, transportation, finance and medicine
2. Design and develop Hadoop
3. Explore the various search methods and visualization techniques.

UNIT I
Introduction to Big Data: What is Analytics, What is Big Data, Characteristics of Big Data, Domain Specific Examples of Big Data, Analytics flow for Big Data-Data Collection Data Preparation, Analysis Types, Analysis Modes, Visualizations, Big Data Stack.

UNIT II
Big data Patterns: Analytics architecture components & Design styles-Load Leveling with Queues, Load Balancing with Multiple Consumers, Leader Election, Sharding, CAP, Lambda Architecture, Scheduler Agent Supervisor, Pipes & Filters, Map Reduce Patterns..

UNIT III
Big Data Implementations
Data Acquisition: Data Acquisition Considerations, Publish - Subscribe Messaging Frameworks, Big Data Collection Systems.
Big Data Storage: HDFS-Architecture

UNIT IV
Batch Analysis: Hadoop and Map Reduce, Hadoop – Map Reduce Examples, Pig, Case Study: Batch Analysis of News Articles, Apache Oozie, Apache Spark.

UNIT V
Serving Databases and Web frameworks: Relational (SQL) Databases, Non-Relational (NoSQL) Databases, Python Web Application Framework – Django.
No SQL: Key-Value Databases, Document Databases, Column Family Databases, Graph Databases.

TEXT BOOKS:

1. Big Data Science and Analytics A Hands-on Approach. By Arshdeep Bahga, Vijay Madisetti

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CSE (DATA SCIENCE)

DEEP LEARNING – C87PC2

B.Tech VII Semester   **L/T/P/C**
                                                                                                                            3 /0/ 0/ 3

COURSE OBJECTIVE:
The course will cover the deep learning and its applications to perceptions in different modalities focusing on those relevant for robotics. It will also cover the algorithms for visual perception and procedure for map building. The course deal with simultaneous localization and mapping based techniques and aspects of imaging techniques used in robotic applications.

COURSE OUTCOMES:
1. Students will be able to understand the concepts of deep learning and Convolution Networks
2. Students will be able to understand the robot perception and cognition.
3. Students will be able to learn the planning of Randomized path for robotic perception.
4. Students will be able to acquire knowledge about localization and mapping techniques.

UNIT I
Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT II
Deep Feed Forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training Tangent Distance, Tangent Prop, and Manifold Tangent Classifier.

UNIT III
Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

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UNIT IV

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks and Bidirectional RNN, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory.

UNIT V

Autoencoders: Under complete Auto encoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Learning Manifolds with Autoencoders, Contractive Autoencoders, Predictive Sparse Decomposition, Applications of Autoencoders.

TEXT BOOKS:

1. Deep Learning, Ian Good Fellow, Yoshua Bengio and Aaron Courville.

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CSE (DATA SCIENCE)

STORAGE AREA NETWORKS - C87PE3

B.Tech VII Semester   **L/T/P/C**
                                                                                                                   3 /0/ 0/ 3

COURSE OBJECTIVES:

1. Understand the need for Storage Area Network and Data protection to satisfy the information explosion requirements. Study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics. To get an insight of Storage area network architecture, protocols and its infrastructure.
2. To study and discuss the applications of SAN to fulfill the needs of the storage management in the heterogeneous environment.
3. Study and understand the management of Storage Networks
4. To understand different techniques of managing store.

COURSE OUTCOMES:

1. Understand different intelligent storage technologies. Also, understand the benefits of Fibre Channel Storage Networks along with iSCSI
2. Understand the architecture of NAS and deployment along with Object based and unified storage technologies. Also, the learner will be able to configure the storage devices to maintain highest level of availability
3. Understand Different techniques for managing and securing storage infrastructure.

UNIT I
Introduction to Information Storage: Information Storage, Data, Types of Data, Big Data, Information, Storage, Evolution of Storage Architecture, Data Center Infrastructure, Core Elements of a Data Center, Key Characteristics of a Data Center, Managing a Data Center
Data Center Environment: Connectivity, Physical Components of Connectivity, Interface Protocols, Storage, Disk Drive Components, Disk Drive performance, Direct-Attached Storage, DAS Benefits and Limitations, Storage Design Based on Application Requirements and Disk Performance, Disk Native Command Queuing, Introduction to Flash Drives, Components and Architecture of Flash Drives, Features of Enterprise Flash Drives, Types of Intelligent Storage Systems.

UNIT II
Introduction to Storage Area Network (SAN), Properties of SANs, Storage networking architecture.
Fibre Channel Storage Area Networks Fibre Channel: Overview, The SAN and Its Evolution , FC Connectivity , Fibre Channel Architecture , Fabric Services , Switched Fabric Login Types , Zoning , FC SAN Topologies , Virtualization in SAN ,iSCSI , FCIP, FCoE

UNIT III
Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization.

Object-Based and Unified Storage: Object-Based Storage Devices**,** Content-Addressed Storage, CAS Use Cases, Unified Storage,

UNIT IV
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis , Business Impact Analysis, BC Technology Solutions
Backup and Archive: Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Target, Data Deduplication for Backup, Data Archive, Archiving Solution, Architecture.
Local and Remote Replication: Uses of Local Replicas , Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Modes of Remote Replication, Remote Replication Technologies, Three-Site Replication.

UNIT V
Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking.
Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution , Information Lifecycle Management, Storage Tiering.

TEXT BOOK:
1. Information, Storage and Management, Second Edition, Soma Sundaram, Gnana Sundaram, Alok Shrivastava, EMC education services, Wiley Inc.

REFERENCE BOOK:
1. Storage Area Network Essentials, Richard Barker and Paul Massiglia, Wiley Computer Publishing

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CSE (DATA SCIENCE)

CYBER SECURITY – C87PE3

B.Tech VII Semester   **L/T/P/C**
                                                                                                                      3 /0/ 0/ 3

COURSE OBJECTIVES:
1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyber laws
3. To study the defensive techniques against these attacks.

COURSE OUTCOMES:
The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT II
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT III
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT IV
Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

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CSE (DATA SCIENCE)

MOBILE APPLICATION DEVELOPMENT – C87PE3

B.Tech VII Semester   **L/T/P/C**
                                                                                                                 3 /0/ 0/ 3

COURSE OBJECTIVES:
1. To demonstrate their understanding of the fundamentals of Android   operating systems
2. To improves their skills of using Android software development tools
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.
4. To demonstrate their ability to deploy software to mobile devices
5. To demonstrate their ability to debug programs running on mobile devices.

COURSE OUTCOMES:
1. Student understands the working of Android OS Practically.
2. Student will be able to develop Android user interfaces

3. Student will be able to develop, deploy and maintain the Android Applications.

UNIT I
Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools.
Android application components - Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes.
Android Application Lifecycle - Activities, Activity lifecycle, activity states, monitoring state changes.

UNIT II
Android User Interface : Measurements – Device and pixel density independent measuring UNIT – s Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers.
Event Handling – Handling clicks or changes of various UI components.
Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT III
Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS.
Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity.
Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT IV
Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.
Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data,

UNIT V
 iOS Programming*: Apps for a Mobile Platform, iOS Benefits, iOS App Development Essentials, The Application Model., Examining an Objective-C Program., Defining Classes, Using Classes, Objects, Methods, and Variables, Managing Memory, Handling Exceptions, Organizing Program Files, Analyzing Objective-C's Object-Orientation Capabilities.

TEXT BOOKS:
1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

REFERENCES:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

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CSE (DATA SCIENCE)

COMPUTER FORENSICS – C87PE4

B.Tech VII Semester   **L/T/P/C**
                                                                                                                   3 /0/ 0/ 3

COURSE OBJECTIVE:

1. Computer forensic a systematic approach to perform comprehensive investigation in order to solve computer crimes.
2. The needs for computer forensic experts in corporations, law firms, insurance agencies, and law enforcement.
3. Evidence retrieved from computers and other digital media are becoming more relevant to convicting hackers and criminals.
4. The course covers both the principles and practice of digital forensics.
5. Methods and standards for extraction, preservation, and deposition of legal evidence in a court of law.

COURSE OUTCOMES:

1. This course provides hands-on experience in different computer forensics situations that are applicable to the real world.
2. Ways to uncover illegal or illicit activities left on disk and recovering files from intentionally damaged media with computer forensics tools and techniques.

UNIT I

Computer Forensics Fundamentals: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement - Computer Forensic Technology - Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined - Data Back-up and Recovery - The Role of Back-up in Data Recovery - The Data - Recovery Solution.

UNIT II

Evidence collection and Data seizure: Why Collect Evidence? Collection Options - Obstacles - Types of Evidence - The Rules of Evidence - Volatile Evidence - General Procedure - Collection and Archiving - Methods of Collection – Artifacts - Collection Steps - Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital
Evidence: Preserving the Digital Crime Scene - Computer Evidence Processing Steps Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication - Practical Consideration - Practical Implementation.

UNIT III

Computer forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, and performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

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UNIT IV
Current Computer Forensic Tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT V
Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS
1. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewal Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

REFERENCE BOOKS
1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education.
2. Forensic Compiling, A Tractitioner is Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, Firewall Media.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH2005.
6. Windows Forensics by Chad Steel, Wiley India.

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CSE (DATA SCIENCE)

REAL TIME DATA STREAMING – C87PE4

B.Tech VII Semester   **L/T/P/C
3 /0/ 0/ 3**

COURSE OBJECTIVE:

1. Introduce the students with data stream models and to present the use cases of stream processing.
2. Present algorithmic techniques for stream processing including random sampling, graph sketches, and merge-and-reduce.
3. Present current techniques on monitoring distributed data streams.
4. Provide practical perspective on analysing data stream systems.
5. Show their application to problems such as subgraph counting, graph connectivity, random sampling from graphs, graph matchings, etc.

COURSE OUTCOMES:

1. Understand the applicability and utility of different machine learning algorithms.
2. Describe and apply current research trends in data-stream processing.
3. Analyze the suitability of stream mining algorithms for data stream systems.
4. Program and build stream processing systems, services and applications.
5. Solve problems in real-world applications that process data streams.

UNIT I
Introduction to Data Streams: Data stream models - basic streaming methods– applications. Change detection - maintaining histograms from data streams

UNIT II
Stream Mining Algorithms: Evaluating streaming algorithms - learning from data streams - evaluation issues – open issues. Clustering from data streams - clustering examples - clustering variables. Frequent pattern mining - frequent Item set mining - heavy hitters - mining frequent item set from data streams - sequence pattern mining.

UNIT III
Classification Methods in Data Streams: Decision trees from data streams - very fast decision tree algorithm (VFDT) – extensions - OLIN: info-fuzzy algorithms. Novelty detection in data streams - learning and novelty - Novelty detection as a one-class classification problem - learning new concepts - the online novelty and drift detection algorithms

UNIT IV
Analysis of Stream Data: Multi-dimensional analysis of data - architecture for on-line analysis of data streams - stream data cube computation. Load shedding in data stream systems - load shedding for aggregation queries - load shedding in aurora - load shedding for sliding window joins - load shedding for classification queries.

UNIT V
Advanced Concepts on Stream Computing: Synopsis construction in data streams - sampling methods - wavelets – sketches – histograms. Join processing in data streams - indexing and querying data streams - Distributed mining of data streams.

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REFERENCES:

1. Charu C. Aggarwal, "Data Streams: Models and Algorithms", Kluwer Academic Publishers, Springer 2007 Edition.
2. Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2010.
3. Byron Ellis, "Real Time Analytics: Techniques to Analyze and Visualize Streaming Data", John Wiley and Sons, 2014.
4. Shilpi Saxena, Saurabh Gupta, "Practical Real-time Data Processing and Analytics", Pack publishing 2017.

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CSE (DATA SCIENCE)

SOFTWARE TESTING METHODOLOGIES – C87PE4

B.Tech VII Semester   **L/T/P/C**
                                                                                                                        3 /0/ 0/ 3

COURSE OBJECTIVE:
To learn the methodologies like flow graphs and path testing, transaction flow testing data flow testing, domain testing and logic base testing adapted in a Software Testing Process.

COURSE OUTCOMES:
1. Find the purpose of testing and taxonomy of bugs, explain flow graphs and path testing process.
2. Explain the process involved in testing transaction flow and data flow scenarios
3. Classify domain testing, infer path, path products and Regular Expressions, illustrate logic based testing.
4. Contrast state, state graphs and transaction testing methods.

UNIT I:
Introduction: Purpose of Testing, Dichotomies, Model for testing, consequences of bugs, taxonomy of bugs.
Flow Graphs And Path Testing: Basic concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT II:
Transaction Flow Testing: Transactions flows, transaction flow testing techniques.
Data Flow Testing: Basics of Data flow testing, strategies in data flow testing, application of dataflow testing.

UNIT III:
Domain Testing: Domains and paths, Nice & Ugly domains, domain testing, domains and interfaces testing, domain and testability.

UNIT IV:
Paths, Path Products and Regular Expressions: Path products & path expression, reduction procedure, applications, regular expressions and flow anomaly detection.
Logic Based Testing: Overview, decision tables, path expressions.

UNIT V:
State, State Graphs and Transition Testing: State graphs, good and bad state graphs, state testing, testability tips.
Graph Matrices And Applications: Motivational Overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Exposure to tools like Test Director or Bad Boy)

TEXT BOOKS:
1. Software Testing Techniques Boris Beizer, Dreamtech, Second Edition.
2. Software Testing Tools- Dr. K.V.K.K.Prasad, Dreamtech.

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REFERENCE BOOKS:
1. The craft of software testing- Brain Marick, Pearson Education.
2. Introduction to Software Testing: P. Ammam & J.Offutt. Cambridge Univ. Press.
3. Software Testing M.G.Limaye TMH
4. Foundations of Software Testing, D. Grahm & Others, Cengage Learning.

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CSE (DATA SCIENCE)

CUTTING EDGE TECHNOLOGIES LAB – C87PC6

B.Tech VII Semester   **L/T/P/C**
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Programs on Hydra Tool

1. Install and configure Hydra and at-least Database engines.
2. Create and Establish a Database connection on POSTGRE, SQL & MYSQL Database engines.
3. Fetch Tables, Columns and Most frequent values in Hydra application
4. Generate relation summary in Hydra
5. Simulate the workload and generate database summary for any database engine.
6. Compare and calculate time complexity for different workloads on POSTGRE Database engine.

Programs on CODD

1. Installation and configuration of CODD
2. Construct Metadata using Construct mode for DB2, Oracle, SQL Server, PostgreSQL and Sybase.
3. Demonstrate metadata retention using retain mode for various database engines.
4. Demonstrate inter engine portability using inter engine mode for meta data transfer
5. Create a Histogram using the predefined set of Classical Distributions.
6. Validate metadata for DB2 Engine using CODD tool.

Programs of PICASSO

1. Installation and configuration of PICASSO
2. Develop a plan diagram to enumerate the execution plan choices
3. Develop a cost diagram to visualize the associated estimated plan execution costs
4. Develop a Reduced plan diagram to show the extent to which original plan diagram may be simplified.
5. Design a schematic plan tree diagram
6. Design a compiled plan tree diagram
7. Design a Foreign plan tree diagram on a database engine
8. Design a abstract plan diagram to visualize the behaviour of selected plan diagram
9. Produce a execution cost diagram to visualize the runtime query response times
10. Produce a cardinality diagram to visualize run time query result cardinalities

Programs of Paramoon

1. Installation and configuration of PARAMOON
2. Develop a scalable (parallel) solution of partial differential equation.

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CSE (DATA SCIENCE)

BIG DATA ANALYTICS LAB - C87PC7

B.Tech VII Semester   **L/T/P/C**
                                                                                                      0 /0/ 2/ 1

COURSE OUTCOMES:

1. Identify the key issues in big data management and experiment with Hadoop framework.
2. Develop problem solving and critical thinking skills in fundamental enable techniques like Hadoop & MapReduce. Construct and Explain with structure and unstructured data by using NoSQL commands.
3. Implement fundamental enabling techniques and scalable algorithms for data stream mining.
4. Implement scientific computing algorithms for finding similar items and clustering.
5. Analyse the algorithms of big data analytics in various applications like recommender systems, social media applications.

LIST OF EXPERIMENTS:

1. Installation of Hadoop Framework, it's components and study the HADOOP ecosystem.
2. Write a program to implement word count program using MapReduce
3. Experiment on Hadoop Map-Reduce / PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication.
4. Install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands.
5. Implementing DGIM algorithm using any Programming Language/ Implement Bloom Filter using any programming language
6. Implement and Perform Streaming Data Analysis using flume for data capture, PYSpark / HIVE for data analysis of twitter data, chat data, weblog analysis etc.
7. Implement any one Clustering algorithm (K-Means/CURE) using Map-Reduce.
8. Implement Page Rank Algorithm using Map-Reduce.

Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web).

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B.TECH – COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)
Course Structure R-20

SEMESTER VIII

S.No.	Class	Course Code	Name of the Subject	L	T	P	C
1	PE	C88PE1	Professional Elective-VI 1. Data Science 2. Quantum Computing 3. Social Networks	3	0	0	3
2	OE	C88OE2	Open Elective-III	3	0	0	3
3	OE	C88OE3	Open Elective-IV	3	0	0	3
4	PW	C88PW4	Major Project Phase II	0	0	20	10
Total Credits							**19**
Major Project Phase II: The approved project in Major Project Phase 1 should be implemented, student should submit the progress of his implementation work in 2 phases, to the PRC(Project Review Committee). The PRC consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide. Upon approval in both the phases, the student is eligible to submit the final project report by completing proper documentation to the external viva voce.							

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CSE (DATA SCIENCE)

DATA SCIENCE – C88PE1

B.Tech VIII Semester   **L/T/P/C**
                                                                             3 /0/ 0/ 3

Course Objectives:
1. Enable You to Analyze of Big Data
2. Learn Techniques and Tools for Transformation of Data
3. Familiarize You with Different Formats
4. Learn Data Visualization and Optimization

COURSE OUTCOMES

1. To correlate data science and solutions to modern problems.

2. To decide when to use which type of technique in data science.

UNIT I

What is Data Science: Computer Science, Data Science, and Real Science, Asking Interesting Questions from Data, Properties of Data, Classification and Regression, Data Science Television: The Quant Shop, About the War Stories, War Story: Answering the Right Question

UNIT II

Scores and Rankings: The Body Mass Index (BMI), Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques, War Story: Clyde's Revenge, Arrow's Impossibility Theorem.

Stastical Analysis: Statistical Distributions, Sampling from Distributions, Statistical Significance, Permutation Tests and P-values, Bayesian Reasoning.

Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations, Reading Graphs.

UNIT III

Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environments.

Linear and Logistic Regression: Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization, Classification and Logistic Regression, Issues in Logistic Classification.

UNIT IV

Distance Network Models: Measuring Distances, Nearest Neighbor Classification, Graphs, Networks, and Distances, Page Rank, Clustering, War Story: Cluster Bombing.

Machine Learning: Naive Bayes, Decision Tree Classifiers, Boosting and Ensemble Learning, Support Vector Machines, Degrees of Supervision, Deep Learning.

UNIT V

Big Data : Achieving Scale: What is Big Data?, Algorithmics for Big Data, Filtering and Sampling, Parallelism, MapReduce, Societal and Ethical Implications.

TEXT BOOKS:

1. The Data Science Design Manual by Steven Skiena, Springer.

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CSE (DATA SCIENCE)
QUANTUM COMPUTING – C88PE1

B.Tech VIII Semester   **L/T/P/C**
                                                                                 3 /0/ 0/ 3

COURSE OBJECTIVES:
1. Learn nano computing challenges
2. Be familiar with the imperfections
3. Be exposed to reliability evaluation strategies
4. Learn nano scale quantum computing
5. Understand Molecular Computing and Optimal Computing

OUTCOMES:
• Discuss nano computing challenges.
• Handle the imperfections.
• Apply reliability evaluation strategies.
• Use nano scale quantum computing.
• Utilize Molecular Computing and Optimal Computing.

UNIT I
Nanocomputing-Prospects and Challenges: Introduction - History of Computing – Nano computing - Quantum Computers – Nano computing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nano computing : Digital Signals and Gates - Silicon Nano electronics - Carbon Nano tube Electronics - Carbon Nano tube Field-effect Transistors – Nano lithography

UNIT II
Nanocomputing with Imperfections: Introduction - Nanocomputing in the Presence of Defects and Faults - Defect Tolerance - Towards Quadrillion Transistor Logic Systems

UNIT III
Reliability of Nanocomputing: Markov Random Fields - Reliability Evaluation Strategies - NANOLAB - NANOPRISM - Reliable Manufacturing and Behavior from Law of Large Numbers.

UNIT IV
Nanoscale Quantum Computing : Quantum Computers - Hardware Challenges to Large Quantum Computers - Fabrication, Test, and Architectural Challenges - Quantum-dot Cellular Automata (QCA) - Computing with QCA - QCA Clocking - QCA Design Rules

UNIT V
Qcadesigner Software and QCA Implementation: Basic QCA Circuits using QCA Designer - QCA Implementation - Molecular and Optical Computing: Molecular Computing - Optimal Computing - Ultrafast Pulse Shaping and Tb/sec Data Speeds.

TEXT BOOK:
1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd. (2008), ISBN (13): 978007024892.

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REFERNCES:

1. Sandeep K. Shukla and R. Iris Bahar., Nano, Quantum and Molecular Computing, Kluwer Academic Publishers (2004), ISBN: 1402080670.
2. Sahni V, Quantum Computing, McGraw Hill Education Asia Ltd. (2007).
3. Jean-Baptiste Waldner, Nanocomputers and Swarm Intelligence, John Wiley & Sons, Inc. (2008), ISBN (13): 978-1848210097.

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CSE (DATA SCIENCE)

SOCIAL NETWORKS – C88PE1

B.Tech VIII Semester   **L/T/P/C**
                                                                            3 /0/ 0/ 3

COURSE OBJECTIVES:
1. Understand the concept of semantic web and related applications.
2. Learn knowledge representation using ontology
3. Understand human behaviour in social web and related communities
4. Learn visualization of social networks

COURSE OUTCOMES
1. Describe the major ideas and models used in the study of networks.
2. Describe the interconnections between the major ideas and models used in the study of networks.
3. Use the major ideas and models used in the study of networks to gain insight into real-world phenomena.
4. Evaluate real, modern research that connects the major ideas and models of networks to real-world phenomena.
5. Create new research that connects the major ideas and models of networks to real-world phenomena.

UNIT I
Social Network analysis: History, concepts and research
Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT II
Extraction and Mining Communities in Web Social Networks: Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT III
Social network Infrastructures and communities: Decentralized online social networks, Multi Relational characterization of dynamic social network communities, Accessibility testing of social websites

UNIT IV
Predicting Human Behaviour and Privacy Issues: Understanding and predicting human behaviour for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

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UNIT V

Visualization and Applications of Social Networks: Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

TEXT BOOKS:
1. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.
    2.   Borko Furht, ―Handbook of Social Network Technologies and Applications,
    1stEdition, Springer, 2010.

REFERENCES:
1. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009.