B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

B.Tech. – III Year I Semester

S.No.	Category	Subject Name	Subject Code	L	T	P	C
1	Professional Core	Machine Learning	V231314431	3	0	0	3
2	Professional Core	Computer Networks	V231314432	3	0	0	3
3	Professional Core	Software Engineering	V231314433	3	0	0	3
4	Professional Elective-I	1. Automata Theory & Compiler Design	V23131C242	3	0	0	3
		2.Object Oriented Analysis and Design	V23131C341				
		3. Soft computing	V231314444				
		4. Internet of Things	V23131C243				
		5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	V231314445				
5	Open Elective- I	Renewable Energy Resources OR Entrepreneurship Development & Venture Creation	V23131025	3	0	0	3
6	Professional Core	Machine Learning Lab	V231314461	0	0	3	1.5
7	Professional Core	Computer Networks Lab	V231314462	0	0	3	1.5
8	Skill Enhancement Course	Full Stack development -1	V231214463	0	1	2	2
		SWAYAM Plus – Data Engineer	V231314464				
		AI Engineer	V231314465				
9	ES	Tinkering Lab *(User Interface Design using Flutter)*	V231314466	0	0	2	1

		SWAYAM Plus - Android Application Development (with Flutter)	V231314467				
10	Evaluation of Community Service Project Internship		V23131CC81	-	-	-	2
Total				**15**	**1**	**10**	**23**

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
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B. Tech– III Year II Semester

S.No	Category	Subject Name	Subject Code	L	T	P	C
1	Professional Core	Deep Learning	V231324431	3	0	0	3
2	Professional Core	Operating Systems	V231324432	3	0	0	3
3	Professional Core	Data Visualization	V231324433	3	0	0	3
4	Professional Elective-II	1. Social Media Analytics	V231324441	3	0	0	3
		2. Cryptography & Network Security	V231324442				
		3. Recommender Systems	V231324443				
		4. Cloud Computing	V231324444				
		5. Sensor Networks	V231324445				
5	Professional Elective-III	1. Software Project Management	V231324446	3	0	0	3
		2. Quantum Computing	V231324447				
		3. Computer Vision	V231324448				
		4. NoSQL databases	V231324449				
		5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	V23132444A				
6	Open Elective – II	Data Base Management Systems	V231324451	3	0	0	3
7	Professional Core	Deep Learning Lab	V231324461	0	0	3	1.5
8	Professional Core	Data Visualization Lab	V231324462	0	0	3	1.5

9	Skill Enhancement Course	Soft skills	V231324463	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	V2313244C1	2	0	0	-
TOTAL				**20**	**01**	**08**	**23**

**** Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application****Note: Student need to do at least ONE MOOC Course (3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations)*

Open Electives, offered to other department students:

Open Elective I: Operating Systems / Computer Organization and Architecture
Open Elective II: Database Management Systems
Open Elective III: Object Oriented Programming Through Java
Open Elective IV: Computer Networks / Software Engineering / IOT Based Smart Systems

Minor Engineering

NOTE:

1. To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.
2. During Minor/Honors Course selection, there should not be any overlapping with Regular/Major/OPEN Electives

Minor in Data Science

1. Introduction to Data Science 3-0-3-4.5 (II-II)
2. Operating Systems 3-0-0-3 (III-I)
3. Data Engineering 3-0-3-4.5 (III-II)
4. Deep Learning 3-0-0-3 (IV-I)

Any of the following 12 Week 3 credit NPTEL MOOC Courses

5. Introduction to Database Systems
6. Artificial Intelligence: Knowledge Representation and Reasoning
7. Computer Networks and Internet Protocol
8. Fundamentals of Object-Oriented Programming
9. Discrete Mathematics for CS
10. Software Engineering

Suggested MOOC Courses for Honors Degree in Data Science

Note: ***To obtain Honor's degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream (without duplication).***

Mandatory Course(s):

1. Deep Learning for Natural Language Processing - 12 Week 3 Credit Course, MOOCS
2. Applied Time-Series Analysis 12 Week 3 Credit Course, MOOCS

Any of the following for remaining 12 Credits

3. Social Network Analysis 12 Week 3 Credit Course, MOOCS
4. Privacy and Security in Online Social Media 12 Week 3 Credit Course, MOOCS
5. Reinforcement Learning 12 Week 3 Credit Course, MOOCS
6. Algorithms in Computational Biology and Sequence Analysis 12 Week 3 Credit Course, MOOCS
7. GPU Architecture and Programming 12 Week 3 Credit Course, MOOCS
8. Quantum Algorithms and Cryptography 12 Week 3 Credit Course, MOOCS
9. Affective Computing 12 Week 3 Credit Course, MOOCS
10. Unmanned Arial Systems & Robotics 12 Week 3 Credit Course, MOOCS

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B. Tech III Year – I Semester

III Year I Semester	MACHINE LEARNING (V231314431)	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of the course are to

1. Define machine learning and its different types (supervised and unsupervised) and understand their applications.
2. Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
3. Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes: At the end of the course, student will be able to

1. Enumerate the Fundamentals of Machine Learning
2. Build Nearest neighbour-based models
3. Apply Models based on decision trees and Bayes rule
4. Make use of Linear discriminates for machine Learning
5. Choose appropriate clustering technique

UNIT – I: Introduction to Machine Learning:

Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT - II: Nearest Neighbour-Based Models:

Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbour Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT - III: Models Based on Decision Trees:

Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. **The Bayes Classifier:** Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Independence and Naive Bayes Classifier (NBC)Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional

UNIT - IV: Linear Discriminates for Machine Learning:

Introduction to Linear Discriminants, Linear Discriminants for Classification, Preceptor Classifier, Preceptor Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Preceptor (MLPs), Back propagation for Training an MLP.

UNIT - V: Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

TEXTBOOKS:

1.“Machine Learning Theory and Practice”, M N Murthy, V S Anantha narayana, Universities Press (India), 2024

Reference Books:

1.“Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017 2.“Machine Learning in Action”, Peter Harrington, Dream Tech Edition, 2019.
3.“Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th

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III Year I Semester	COMPUTER NETWORKS (V231314432)	L	T	P	C
		3	0	0	3

Course Objectives:

The course is designed to

1. To understand the different types of networks
2. To develop an understanding the principles of computer networks.
3. To familiarize with Reference model OSI and TCP/IP
4. To understand various layers of Reference models functions
5. To explore network protocols

Course Outcomes (CO):

After completion of the course, students will be able to

1. Understand the reference models and network protocols
2. Describe data transmission media and data link layer.
3. Understand the network layer design issues and Network layer Protocols.
4. Evaluate transport layer services and its protocols.
5. Understand application layer protocols and their uses

UNIT - I: Introduction

Types of Computer Networks, Reference Models- The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model. History of Internet.

UNIT -II: The Data Link Layer

Transmission Media, Guided and Un-guided media, Data Link Layer Design Issues, Services Provided to the Network Layer, Error detecting and Error Correcting codes, Elementary Data Link Protocols, Sliding Window Protocols, HDLC, PPP. Multiple Access Protocols Wired Lans: Ethernet, Fast Ethernet, Gigabit Ethernet

UNIT - III: The Network Layer

Network Layer Design Issues, Routing Algorithms, Congestion, Congestion control algorithms. The Network Layer in the Internet, The IP Version 4 Protocol, IP Addresses Classful, CIDR, NAT, IP Version 6 Protocol, Transition from IPV4 to IPV6

UNIT -IV: The Transport Layer

The Transport Layer Services, Transport Layer Protocols: UDP, TCP and SCTP

UNIT -V: The Application Layer

The World Wide Web, HTTP, Domain Name Space, Remote Loging, Electronic Mail and File Transfer

Textbooks:

1. "Computer Networks", Andrew S Tanenbaum, David J Wetherall, 5th Edition, Pearson

2. "Data Communications and Networking", Behrouz A Forouzan, 4th Edition, Tata McGraw Hill Education

Reference Books:

2. "TCP/IP Protocol Suite", Behrouz Forouzan, McGraw Hill.
1. "Data and Computer Communication", William Stallings, Pearson

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III Year I Semester	SOFTWARE ENGINEERING (V231324433)	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

1. Software lifecycle models, Software requirements and SRS document.
2. Project Planning, quality control and ensuring good quality software.
3. Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

UNIT - I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT - II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT - III:

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT - IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** testing object-oriented

programs, Smoke testing, and some general issues associated with testing.

Software Reli ability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNIT - V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: Reuse-definition, Introduction, Reason behind no reuses of ar, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, RajibMall,5thEdition, PHI.
2. Software Engineering a Practitioner's Approach, Roger S. Pressman, 9thEdition, McGraw Hill International Edition.

Reference Books:

1. Software Engineering, IanSommerville,10thEdition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Resources:

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126058950638714882 7_shared/overview
   35_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0133826904110039047

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III Year I Semester	AUTOMATA THEORY AND COMPILER DESIGN (PROFESSIONAL ELECTIVE -I) (V2313244)	L	T	P	C
		3	0	0	3

Course Outcomes: After completion of this course

1.Understand and apply formal language theory.
2.Design and implement parsers.
3.Understand the phases of a compiler.
4.Apply semantic analysis and error handling.
5.Optimize intermediate and target code

UNIT – I:

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA.

UNIT – II:

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma. Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT – III:

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines

UNIT – IV:

Introduction: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex.

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down

Parsing, Bottom- Up Parsing.

Introduction to LR Parsing: Simple LR, More Powerful LR Parsers R18 B.Tech. CS&D

UNIT – V:

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management

Text Books:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
3. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd Edition, PHI.

Reference Books:

1. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
4. Compiler Construction, Kenneth C. Louden, Thomson. Course Technology.
3. Lex &Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly

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III Year I Semester	OBJECT ORIENTED ANALYSIS AND DESIGN (PROFESSIONAL ELECTIVE -I) (V23131C341)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective is the students to

1. Become familiar with all phases of OOAD.
2. Master the main features of the UML.
3. Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
4. Learn the Object design Principles and understand how to apply them towards Implementation.

UNIT - I:

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems.

Case Study: System Architecture: Satellite-Based Navigation

UNIT - II:

Introduction to UML: Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.

Case Study: Control System: Traffic Management.

UNIT - III:

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

UNIT - IV:

Basic Behavioural Modeling-I: Interactions, Interaction diagrams Use cases, Use case

Case Study: Web Application: Vacation Tracking System ,Diagrams, Activity Diagrams.

UNIT-V:

Advanced Behavioural Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams **Case Study:** Weather Forecasting

Text Books:

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", 3rd edition,2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. PascalRoques:ModelingSoftwareSystemsUsingUML2,WILEY- Dream tech India Pvt.Ltd.
3. Atul Kahate: Object Oriented Analysis &Design, The McGraw-Hill Companies. Unified Process, Craig Larman, Pearson Education.
Appling UML and Patterns: An introduction to Object–Oriented Analysis and Design and

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III Year I Semester	SOFT COMPUTING (PROFESSIONAL ELECTIVE -I) (V231314444)	L	T	P	C
		3	0	0	3

Course Objectives:

To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrids.

Course Outcomes: The students will be able to

1. Learn soft computing techniques and their applications.
2. Analyze various neural network architectures.
3. Define the fuzzy systems.
4. Understand the genetic algorithm concepts and their applications.
5. Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution

UNIT - I:

Introduction to Soft Computing, Artificial neural networks, biological neurons, Basic models of artificial neural networks, Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

UNIT - II:

Perceptron networks, learning rule, Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network, Architecture, Training algorithm

UNIT - III:

Fuzzy logic, fuzzy sets, properties, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations, Fuzzy membership functions, fuzzification, Methods of membership, value assignments, intuition, inference, rank ordering, Lambda –cuts for fuzzysets, Defuzzification methods.

UNIT - IV:

Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules, Decomposition of rules, Aggregation of rules, Fuzzy Inference Systems, Mamdani and Sugeno types, Neuro-fuzzy hybrid systems, characteristics, classification.

UNIT - V:

Introduction to genetic algorithm, operators in genetic algorithm, coding, selection, crossover, mutation, stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic Fuzzy rule-based system

Text Books:

1. S. N. Sivan and amand S. N. Deepa, Principles of soft computing–John Wiley & Sons,2007.
2016.
2. Timothy J. Ross, Fuzzy Logic with engineering applications, John Wiley& Sons,

Reference Books:

1. N. K. Sinhaand M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation-Prentice Hall International, Inc.1998
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Driankov D., Hellendoorn H.and Reinfrank M., An Introduction to Fuzzy Control Narosa Pub., 2001.
5. BartKosko, Neural Network and Fuzzy Systems-Prentice Hall, Inc., Englewood Cliffs, 1992
Addison Wesley, 1989
6. Goldberg D.E.,Genetic Algorithms in Search, Optimization, and Machine Learning

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III Year I Semester	INTERNET OF THINGS (PROFESSIONAL ELECTIVE -I) (V23131C243)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Vision and Introduction to Internet of Things (IoT).
2. Understand IoT Market perspective.
3. Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes (COs): At the end of the course, student will be able to

1. Explain in a concise manner how the general Internet as well as Internet of Things work.
2. Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
3. Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
4. Develop prototype models for various applications using IoT technology.

UNIT-I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT-II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT-III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols

for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT-IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes Enterprise Systems. in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and

UNIT-V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A. Bahgya and V. Madisetti, University Press, 2015

Reference Books:

Getting Started with the Internet of Things, Cuno Pfister, Oreilly
1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley

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III Year I Semester	MACHINE LEARNING LAB (V231314461)	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To learn about computing central tendency measures and Data pre-processing techniques
2. To learn about classification and regression algorithms
3. To apply different clustering algorithms for a problem.

Course Outcomes: After the completion of this course, the students will be able to:

1. Develop program for computing central tendency measures and Apply Data
2. Pre-processing techniques
3. Build Classifiers using KNN, Decision Tree, Random Forest algorithms
4. Implement classification algorithms such as Naïve Bayes, SVM, Multi-Layer Perceptron

5.Apply clustering algorithms such as K-Means, Fuzzy C-Means and Expectation Maximization for a problem

Software's Required: Python/R/Weka

List of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset. a. Attribute selection
   b. Handling Missing Values
   c. Discretization
   d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem

6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from K. its class centre. Test the performance of the algorithm as a function of the parameters
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

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III Year I Semester	COMPUTER NETWORKS LAB (V231314462)	L		T	P	C
		0		0	3	1.5

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer farming methods such as i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer farming method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Go back N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra‘s algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
    - i. Packet Capture Using Wire shark
    - ii. Starting Wire shark
    - iii. Viewing Captured Traffic
    - iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
    - i. NS2 Simulator-Introduction
    - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
    - ii. Simulate to Find the Number of Packets Dropped
    - iv. Simulate to Find the Number of Packets Dropped due to Congestion

v. Simulate to Compare Data Rate& Throughput.

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year I Semester	FULL STACK DEVELOPMENT – I (SKILL ENHANCEMENT COURSE) (V231314463)	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

1. Make use of HTML elements and their attributes for designing static webpages.
2. Build a webpage by applying appropriate CSS styles to HTML elements.
3. Experiment with Java Script to develop dynamic webpages and validate forms.

Experiments covering the Topics:

1. Lists, Links and Images
2. HTML Tables, Forms and Frames
3. HTML5 and Cascading Style Sheets, Types of CSS
4. Selector forms
5. CSS with Color, Background, Font, Text and CSS Box Model
6. Applying Java Script-internal and external, I/O, Type Conversion
7. JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
8. JavaScript Functions and Events
9. Node.js

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested list and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using<a>tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also, when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique istousethumbnailsbysettingtheheightandwidthparameterstosomething like to 100*100 pixels. Each thumbnail image is also a link to a full-sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, row span, cols pan)

b.(Note: Use <caption>tag to set the caption to the table & also use cell spacing, cell .Write a HTML program, to explain the working of tables by preparing a timetable. padding, border, row span, col span etc.).

c. Write a HTML program, to explain the working of forms by designing Registration form. (Note:

Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags<text area>and two buttons i.e. submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided

into3parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of<article>,<aside>,<figure>,<figcaption>,<footer>, <header>,<main>,<nav>,<section>, ,tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (of levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms

- Simple selector (element, id, class, group, universal)
- Combinator selector (descendant, child, adjacent sibling, general sibling)
- Pseudo-class selector
- Pseudo-element selector
- Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.

b. Write a CSS rule that places a background image half way down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.

c. Write a program using

the following terms related to CSS font and text:

i.font-size

ii.font-weight

iii.font-style

iv.text-decoration

v.text-transformation

vi.text-alignment

d. Write a program, to explain the importance of CSS Box model using

i. Content

ii. Border

iii. Margin

iv. Padding

6. Applying JavaScript-internal and external, I/O, Type Conversion

a. Write a program to embed internal and external Java Script in a web page

b. Write a program to explain the different ways for displaying output.

c. Write a program to explain the different ways for taking input.

d. Create a web page which uses prompt dialogue box to ask a voter for his name and age. Displaythe information in table format along with either the voter can vote or not

7. Java Script Pre-defined and User-defined Objects

a. Write a program using document object properties and methods

b. Write a program using window object properties and methods.

c. Write a program using array object properties and methods.

d. Write a program using math object properties and methods.

e. Write a program using string object properties and methods.

f. Write a program using regex object properties and methods.

g. Write a program using date object properties and methods.

h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. Java Script Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGERNUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".

b. Write a program to display weekdays using switch case.

c. Write a program to print1to10 numbers using for, while and do-while loops. d. Write a program to print data in object using for-in, for-each and for-of loops e. Develop a program to determine whether a given number is an 'ARMSTRONGNUMBER' or not. [Ex: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+33 = 153]

f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's,20's,10's,5's,2's&1's.(Ex: If deposited amount is Rs.163, the output shouldbe1-100's,1- 50's, 1-10's, 1-2's & 1-1's)

9. Java Script Functions and Events

a. Design a appropriate function should be called to display

- Factorial of that number
- Fibonacci series up to that number
- Prime numbers up to that number
- Is it palindrome or not

b. Design a HTML having a textbox and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display

- Factorial of that number
- Fibonacci series up to that number

• Prime numbers up to that number

c. Write a program to validate the following fields in a registration page

Is it palindrome or not

i. Name (start with alphabet and followed by alphanumeric and the length should not

be less than 6 characters)

ii. Mobile (onlynumbersandlength10 digits)

iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. ProgrammingtheWorldWideWeb,7th Edition, Robet W Sebesta, Pearson, 2013.

2. WebProgrammingwithHTML5, CSS and JavaScript, John Dean, Jones &Bartlett Learning, 2019 (Chapters 1-11).

3.ProMERNStack:FullStackWebAppDevelopmentwithMongo,Express,React,and Node, Vasan Subramanian, 2nd edition, A Press, O'Reily

Web Links:

Infosys spring board*

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/typescript

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year I Semester	TINKERING LAB (USER INTERFACE DESIGN USING FLUTTER) (V231314466)	L	T	P	C
		0	0	2	1

Course Objectives:

1. Learns to Implement Flutter Widgets and Layouts
2. Understands Responsive UI Design and with Navigation in Flutter
3. Knowledge on Widges and customize widgets for specific UI elements, Themes
4. Understand to include animation apart from fetching data

List of Experiments:

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
b) Implement navigation with named routes.
5. a) Learn about stateful and stateless widgets.
b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
b) Use Flutter's debugging tools to identify and fix issues.

Text Book:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development. Apps

1stEdition, Apres.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

B. Tech III Year – II Semester

III Year II Semester	DEEP LEARNING (V231324431)	L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memory cells and convolution neural networks.

Course Outcomes:

After completion of course, students would be able to:

1. Explore feed forward networks and Deep Neural networks
2. Mathematically understand the deep learning approaches and paradigms
3. Apply the deep learning techniques for various applications

UNIT-I:

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thres holding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

UNIT-II:

Feed forward Networks- Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, autoencoders.Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

UNIT-III:

Better Training of Neural Networks –Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point proble minneural networks, Regularization methods (dropout, drop connect, batch normalization).

UNITIV:

Recurrent Neural Networks- Back propagation through time, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.Convolutional Neural Networks: LeNet, Alex Net. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNITV:

Speech Recent trends- Variational Autoencoders, Transformers, GPT Applications: Vision, NLP,

Text Books:

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016

Reference Books:

1. Neural Networks: A Systematic Introduction, RaúlRojas,1996
2. Deep Learning with Python, François Chollet, Manning Publications,2017
3. Pattern Recognition and Machine Learning, Christopher Bishop,2007

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	OPERATING SYSTEMS (V231324432)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course are to make student.

Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection

1. Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
2. Illustrate different conditions for deadlock and their possible solutions.
3. **UNIT – I:**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System

Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV

Memory- Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement Allocation of frames, Thrashing.

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File system Implementation: File-system structure, File-system Operations, Directory.

File System: File System Interface: File concept, Access methods,

Directory Structure: implementation, Allocation method, Free space management.

File-System Internals: File System Mounting, Partitions and Mounting, File Sharing.

Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix

Text Books:

1. Operating System Concepts, Silberschatz A, GalvinPB, GagneG,10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum AS,4th Edition, Pearson ,2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D. M Dhamdhere, 3rd Edition, McGraw Hill, 2013

Online Learning Resources:

1.http://peterindia.net/OperatingSystems.html
2. https://nptel.ac.in/courses/106/106/106106144/

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	DATA VISUALIZATION (V231324433)	L	T	P	C
		3	0	0	3

Pre-Requisites: Computer Graphics, Image Processing

Course Objective:

1. Familiarize students with the basic and advanced techniques of information visualization and scientific visualization
2. Learn key techniques of the visualization process
3. A detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	**Explain** Visualization and representation of data .	K6
CO2	**Creating** visual representations and visualization reference model of applications	K3
CO3	**Classify** the visualization systems in a data representation	K4
CO4	**Identify** Visualization of groups and trees	K3

CO5	**Determine** the visualization of volumetric different data sets in applications	**K6**

SYLLABUS:

UNIT-I: 1

Introduction: What Is Visualization? History of Visualization, Relationship between Visualization and Other Fields, The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

UNIT-II:

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications

UNIT-III:

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT-IV:

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

UNIT-V:

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Text Books:

1. WARD, GRINSTEIN, KEIM.I interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.

2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

Resources:

https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	SOCIAL MEDIA ANALYTICS (PROFESSIONAL ELECTIVE - II) (V231324441)	L	T	P	C
		3	0	0	3

Course Objectives:

Knowledge on social media and its analytics Course

Course Outcomes:

1. Understanding characteristic sand types of social media
2. Knowledge on layers of social media analytics
3. Apply text analysis tools on social media data
4. Understand the significance of action analytics
5. Detect viral topics on social media (YouTube)

UNIT - I:

Introduction to Social Media, World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, j Core Characteristics of Social Media, Types of Social Media, Social Networking Sites, Using Face book for Business Purposes, Content Communities

UNIT - II:

Social Media Analytics Overview, Purpose of Social Media Analytics, social media Vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, social media Analytics Tools. Case Study: The Underground Campaign That Scored Big

UNIT - III:

Social Media Text Analytics, Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools. CaseStudy: Tapping Into Online Customer Opinions

UNIT - IV:

Social Media Actions Analytics, Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group

Unit - V:

Social Media Hyperlink Analytics Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Hyperlink Analytics Tools. Case Study: Hyperlinks And Viral YouTube Videos

Text Books:

Seven Layers of Social Media Analytics Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data by Gohar F. Khan Isbn: 1507823207, Isbn-13: 9781507823200

Reference Books:

1. Social Media by Matthew Ganis, Avinash Kohirkar, Pearson Education.
2. Social Media Analytics: Techniques And Insights for Extracting Business Value Out of
3. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
4. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan,WileyPublications.
5. Big Data, Black Booktm, Dreamtech Press,2015Edition.

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	CRYPTOGRAPHY &NETWORK SECURITY (PROFESSIONAL ELECTIVE -II) (V231324442)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Explain the objectives of information security
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability
3. Understand the basic categories of threats to computers and networks
4. Discusses the Mathematics of Cryptography
5. Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
6. Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	networks and learn different symmetric key techniques Student will be able to understand security issues related to computer	K2
CO2	Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	K3
CO3	algorithms Students will be able learn different types of symmetric and Asymmetric	K3
CO4	authentication and digital signature and their importance to the security Students will be able learn different algorithms of Hash functions, message	K4
CO5	Application Layer, Transport Layer and Network layer Students will be able learn different Enhanced security protocols of	K4

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

SYLLABUS:

UNIT – I:

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

UNIT – II:

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2) fields, Polynomials.

Mathematics of Asymmetric cryptography: Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT – III: Symmetric key Ciphers: Block Cipher principles, DES, AES, Blow fish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT – IV:

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA)

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT – V:

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson. 3. Modern Cryptography: Theory and Practice by Wenbo

Mao. Pearson

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	RECOMMENDER SYSTEMS (PROFESSIONAL ELECTIVE - II) (V231324443)	L	T	P	C
		3	0	0	3

Course Objectives:

This course covers the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences

Course Outcomes:

1. Describe basic concepts behind recommender systems
2. Explain a variety of approaches for building recommender systems
3. Describe system evaluation methods from both algorithmic and users' perspectives
4. Describe applications of recommender systems in various domain

UNIT - I:

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT - II:

Collaborative Filtering: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

UNIT - III:

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT - IV:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT - V:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

Recommender Systems and communities: Communities, collaboration and recommender recommendations systems in personalized web search, social tagging recommender systems, Trust and

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer (2011), 1st ed.

References:

Springer (2013), 1st ed.
1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems for Learning,

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	CLOUD COMPUTING (PROFESSIONAL ELECTIVE -II) (V231324444)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To explain the evolving utility computing model called cloud computing.
2. To introduce the various levels of services offered by cloud.
3. To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
4. To emphasize the security and other challenges in cloud computing.
5. To introduce the advanced concepts such as containers, server less computing and cloud centric Internet of Things.

UNIT - I: **Introduction to Cloud Computing Fundamentals**

Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT - II: **Cloud Enabling Technologies**

Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT - III: **Virtualization and Containers**

Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings. **UNIT-IV**: **Cloud computing challenges**

Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V: **Advanced concepts in cloud computing**

Server less computing, Function-as-a-Service, server less computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) server less platforms, Internet of infrastructure-as-code, quantum cloud computing. Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps,

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.

2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.

2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.

GCP)

3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure,

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	SENSOR NETWORKS (PROFESSIONAL ELECTIVE -II) (V231324445)	L	T	P	C
		2	0	0	3

Course Outcomes:

1. To provide an overview about sensor networks and emerging technologies.
2. To study about the node and network architecture of sensor nodes and its execution environment.
3. To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN.
4. To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control
5. To study about sensor node hardware and software platforms and understand the simulation and programming techniques.

UNIT-I: Introduction and Overview:

Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characterise, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

UNIT-II: Architectures:

Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks - single hop vs. multi hop networks, multiple sources and sinks - mobility, optimization goals and figures of merit, gateway concepts, design principles for WNs, service interfaces for WSNs. **UNIT- III: Communication Protocols**:

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC, the mediation device protocol, wakeup radio

concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routin inicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

UNIT- IV: Infrastructure Establishment:

Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and synchronization, properties, protocols based on sender-receiver and receiver-receiver approaches, single-hop localization, positioning in multi-hop environment, range-based localization algorithms - location services, sensor tasking and control.

UNIT-V: Sensor Network Platforms and Tools:

Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

Text Books:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Reference Books:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.

2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008. 2003.

4. Edgar Callaway, "Wireless Sensor Networks: Architectures and Protocols", Auerbach,

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V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	SOFTWARE PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE -III) (V231324446)	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of the course, the student shall be able to:

1. To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2. To compare and differentiate organization structures and project structures • To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT- III:

Model based software architectures: A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows. **Checkpoints of the process: Major** mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT- IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment. **Project Control and Process instrumentation:** The seven core Metrics, Management automation. indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics **UNIT-V:**

Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TM 2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005. 5. Project Management in IT, Kathy Schwalbe, Cengage
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	QUANTUM COMPUTING (PROFESSIONAL ELECTIVE -III) (V231324447)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

UNIT - I

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT-II

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT - III

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT - V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

Reference Books:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I: Basic Concepts, Vol II
   Quantum Computing Algorithms
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to

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III Year II Semester	COMPUTER VISION (PROFESSIONAL ELECTIVE -III) (V231324448)	L	T	P	C
		3	0	0	3

Course Objectives:
To understand the Fundamental Concepts related to sources, shadows and shading
To understand the Geometry of Multiple Views
Course Outcomes:
Implement fundamental image processing techniques required for computer vision
Implement boundary tracking techniques
Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
Apply 3D vision techniques and Implement motion related techniques.
Develop applications using computer vision techniques.
UNIT – I:
CAMERAS: Pinhole Cameras Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.
UNIT - II:
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge
Detection: Noise, Estimating Derivatives, Detecting Edges Texture 0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.
UNIT - III:
The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,
UNIT - IV:
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice,
Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association,

UNIT - V:

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. London Limited 2011.

Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	NO SQL DATABASES (PROFESSIONAL ELECTIVE -III) (V231324449)	L	T	P	C
		3	0	0	3

Pre-requisites: Basic Knowledge about DBMS

Course Outcomes: At the end of the Course the student will be able to

CO1: Explain and compare different types of NoSQL Databases

CO2: Compare and contrast RDBMS with different NoSQL databases.

CO3: Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.

CO4: Explain the performance tune of Key-Value Pair NoSQL databases.

CO5: Apply Nosql development tool so n different types of No SQL Databases.

UNIT - I

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT - II

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, Map Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT - III

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT - IV

Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT - V

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases,

Storing Session Information, User Profiles, Preferences, Shopping Cart Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

1. Sadalage, P. & Fowler, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Wiley Publications,1st Edition,2019.

Web References :

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp4.
https://www.javatpoint.com/nosql-databa
3. https://www.geeksforgeeks.org/introduction-to-nosql/

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	DATABASE MANAGEMENT SYSTEMS **(OPEN ELECTIVE-II)** (V231324451)	L	T	P	C
		3	0	0	0

III Year II Semester

L	T	P	C
3	0	0	0

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNITI: Introduction: Database system, Characteristics(Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.
Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, . BASIC SQL: Simple Database schema, data types

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logicaloperations,SQLfunctions(DateandTime,Numeric,Stringconversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, 1NF, 2NF and 3 NF, conceptofsurrogatekey,Boyce-Coddnormalform(BCNF),MVD,Fourthnormal

form(4NF), Fifth Normal Form (5NF).

UNITV: Transaction Concept: Transaction State, ACID properties, Concurrent Executions,Serializability,Recoverability,ImplementationofIsolation,Testing for serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+Trees, operations on B+Trees,

Text Books:

1) Database Management Systems, 3rdedition,RaghuramaKrishnan,Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) DatabaseSystemConcepts,5thedition,Silberschatz,Korth,Sudarsan,TMH(For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Data base Systems, 8thedition, CJDate, Pearson.
2. Data base Management System, 6thedition, RamezElmasri, ShamkantB.Navathe, Pearson
3. DatabasePrinciplesFundamentalsofDesignImplementationandManagement, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	DEEP LEARNING LAB (V231324461)	L	T	P	C
		0	0	3	1.5

Course Outcomes: On completion of this course, the student will be able to

1. Implement deep neural networks to solve real world problems
2. Choose appropriate pre-trained model to solve real time problem
3. Interpret the results of two different deep learning models

Software Packages required:

- Keras
- Tensorflow
- PyTorch

List of Experiments:

1. Implement multi-layer perceptron algorithm for MNIST Handwritten Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Handwritten Digit Classification.
6. Build a Convolution Neural Network for simple image(dogs and Cats) Classification
7. Use a pre-trained convolution neural network (VGG16) for image classification.
8. Implement one hoten coding of words or characters.
9. Implement word embeddings for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books:

1. Reza Zadehand Bharath Ram sundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

References:

1. https://github.com/fchollet/deep-learning-with-python-notebooks

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	DATA VISUALIZATION LAB (V231324462)	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To visualize the different datasets using histograms, line charts.
2. To understand the use of bar charts and box plots.
3. To understand Scatter plots, mosaic plots
4. To understand different Map visualizations
5. To learn advanced graphs such as correlogram, heatmap and 3D graphs.

Course Outcomes: At the end of the course student will be able to

1. Visualize the different datasets using histograms, line charts.
2. Makeuse of bar charts and box plots on different datasets
3. Apply Scatter plots, mosaic plots in R for different datasets
4. Apply different Map visualizations in R
5. Create advanced graphs such as correlogram, heatmap and 3D graphs. **List of**

Experiments:

1. a) Load VADeaths(Death Rates in Virginia)dataset in R and visualize the data using different histograms.

b) Load air quality dataset in R and visualize La Guardia Airport's dialy maximum temperature using histogram.

2. Load AirPassengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.

3. a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots.

b)Load air quality dataset in R and visualize ozone concentration in air.

4. a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species.

b) Load air quality dataset in R and visualize air quality parameters using box plots.

5. Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other. points using hexagon binning and also add color palette then use the

6. Load diamonds dataset in R and visualize the structure in datasets with large data
7. Load HairEyeColor dataset in R and plot categorical data using mosaic plot.
8. Load mtcars dataset in R and visualize data using heat map.
9. Install leaflet library in R and perform different map visualizations.
10. Visualize iris dataset using 3d graphs such as scatter3d, cloud, xyplot.
11. Make use of correlogram to visualize data in correlation matrices for iris dataset.
12. Install maps library in R and draw different map visualizations.

Web References:

1. https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/
2. https://www.geeksforgeeks.org/data-visualization-in-r/

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B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	SOFT SKILLS (SKILL ENHANCEMENT COURSE) (V231324463)	L	T	P	C
		0	1	2	2

Course Objectives:

1. To equip the students with the skills to effectively communicate in English
2. To train the students in interview skills, group discussions and presentation skills
3. To motivate the students to develop confidence
4. To enhance the students' interpersonal skills
5. To improve the students' writing skills

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talkby Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non-Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Black swan, 2010.

Reference books:

1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

B.TECH COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
V23–IIIYEARCOURSESTRUCTURE&SYLLABUS

III Year II Semester	TECHNICAL PAPER WRITING & IPR (V2313244C1)	L	T	P	C
		2	0	0	-

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

UNIT- I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

UNIT-II:

Drafting report and design issues: The use of drafts, Illustrations and graphics. **Final edits:** Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

UNIT-III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

UNIT-IV: Using word processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

UNIT-V:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Reference Books:

Dordrecht Heidelberg London, 2011.

1. Adrian Wallwork , English for Writing Research Papers, Springer New York

2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

E-resources:

1. https://www.udemy.com/course/reportwriting/

2. https://www.udemy.com/course/professional-business-english-and-technical-report 3. https://www.udemy.com/course/betterbusinesswriting/ writing/