J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOMOUS)

Bhaskar Nagar, Moinabad Mandal, R.R. District, Hyderabad -500075

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M. Tech - COMPUTER SCIENCE AND ENGINEERING (CSE)
EFFECTIVE FROM ACADEMIC YEAR 2024-2025 ADMITTED BATCH

R24 COURSE STRUCTURE AND SYLLABUS

I YEAR – I SEMESTER							
Sl.No.	**CODE**	**CORE / ELECTIVE**	**COURSE TITLE**	**L**	**P**	**T**	**C**
1.		**Core - I**	Advanced Data Structures	3	0	0	3
2.		**Core - II**	Advanced Operating Systems	3	0	0	3
3.		**Professional Elective - I**	1. Modern Database Management Systems 2. Advanced Computer Networks 3. Cloud Computing	3	0	0	3
4.		**Professional Elective - II**	1. Advanced Software Engineering 2. Cryptography and Network Security 3. Data Science	3	0	0	3
5.		**Lab - I**	Advanced Data Structures Lab	0	0	4	2
6.		**Lab - II**	Advanced Operating Systems Lab	0	0	4	2
7.		**MC - I**	Soft Skills	2	0	0	0
TOTAL CREDITS				**14**	**0**	**8**	**16**

I YEAR – II SEMESTER							
Sl.No.	**CODE**	**CORE / ELECTIVE**	**COURSE TITLE**	**L**	**P**	**T**	**C**
1.		**Core - III**	Advanced Algorithms	3	0	0	3
2.		**Core - IV**	Machine Learning	3	0	0	3
3.		**Professional Elective - III**	1. Bigdata Analytics 2. Wireless Sensor Networks 3. Computer Vision	3	0	0	3
4.		**Professional Elective - IV**	1. High Performance Computing 2. Internet of Things 3. Fog and Edge Computing	3	0	0	3
5.		**Core - IV**	Research Methodology and IPR				
6.		**Lab - I**	Advanced Algorithms Lab	0	0	4	2
7.		**Lab - II**	Machine Learning Lab	0	0	4	2
8.		**MC - I**		2	0	0	0
TOTAL CREDITS				**14**	**0**	**8**	**16**

II YEAR – I SEMESTER							
Sl.No.	**CODE**	**CORE / ELECTIVE**	**COURSE TITLE**	**L**	**P**	**T**	**C**
1.		**Professional Elective - V**	1. Deep Learning	3	0	0	3
2.			2. Blockchain Technology	3	0	0	3
3.			3. Quantum Computing	3	0	0	3
4.		**Open Elective - II**	Open elective				
5.			Mini Project	0	0	4	2
6.			Technical Seminar	0	0	2	1
7.		**Major Project**	Major Project Phase-I Dissertation	0	0	20	09
				6	0	26	18

II YEAR – II SEMESTER							
Sl.No.	**CODE**	**CORE / ELECTIVE**	**COURSE TITLE**	**L**	**P**	**T**	**C**
1.		**Major Project**	Major Project Phase-II Dissertation	**3**	**0**	**0**	**3**
TOTAL CREDITS				**0**	**0**	**32**	**16**
GRAND TOTAL CREDITS							**68**

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED DATA STRUCTURES	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Programming for Problem Solving, Data Structures

Course objectives:

1. Introduces the heap data structures such as leftist trees, binomial heaps, Fibonacci and minmax heaps
2. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

Module 1:

Heap Structures

Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

Module 2:

Hashing and Collisions

Introduction, Hash Tables, Hash Functions, different Hash Functions: Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

Module 3:

Search Structures: OBST, AVL trees, Red-Black trees, Splay trees, Multiway Search Trees: B-trees, 2-3 trees

Module 4:

Digital Search Structures

Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

Module 5:

Pattern matching

Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp

TEXT BOOKS:

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

REFERENCES:

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED OPERATING SYSTEMS	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Programming for Problem Solving, Operating Systems

Course objectives:

1. To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems)
2. Hardware and software features that support these systems.

Module 1: Processes and Scheduling:

Process States and System Call Interface; Life Cycle of a Process: Process Dynamics; Scheduler: working and implementation; Linux Process States and System Calls; Process Groups, Sessions, Foreground and Background Processes.

Module 2: Interprocess Communication and Synchronisation:

Signals, Pipes and Named Pipes (FIFOs); Threads and pthread library; Mutexes and Condition Variables; Semaphores; Producer-Consumer Problem and Solutions using mutexes, condition variables and semaphores.

Module 3: Files and File Systems

File and File Meta-data; File Naming Systems; File System Operations; File System Implementation; File System Structures; Booting an OS; File System Optimization.

Module 4: Devices and Device Drivers

Devices and Types of Devices; Terminal, Disk, SCSI, Tape and CD devices; Unification of Files and Devices; Device Drivers: Concepts and Implementation Details.

Module 5: Resource Management and Security:

Resource Management Issues; Types of Resources; Integrated Resource Scheduling; Queuing Models of Scheduling; Protection of Resources – hardware, software, and attacks; Security Policies.

TEXT BOOKS:

1. Charles Crowley. Operating Systems: A Design-Oriented Approach, Tata McGraw-Hill
2. Richard Stevens, Stephen Rago. Advanced Programming in the Unix Environment, Addison-Wesley (2013).

REFERENCE BOOKS

1. Maekawa, M. and Arthur E. Oldehoeft and Oldehoeft, R.R. Operating Systems: Advanced Concepts, Benjamin Cummings (1987).
2. David A. Rusling. The Linux Kernel, http://www.tldp.org/LDP/tlk/tlk.html

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	MODERN DATABASE MANAGEMENT SYSTEMS (PROFESSIONAL ELECTIVE-I)	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Basic RDBMS concepts and SQL

Course objectives:

1. To understand the design, querying, storage management and transaction processing of SQL and NoSQL databases.
2. To learn advanced database design principles – graph databases, columnar databases and document databases.

MODULE-1:

Overview of RDBMS – Storage and File Structures, Indexing and Hashing – Indexing Structures – Single and Multi-level indexes. Query Processing Optimization and Database Tuning: – Algorithms for Query Processing and Optimization- Physical Database Design and Tuning.

MODULE-2:

Intermediate and Advanced SQL – Embedded SQL Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features.

MODULE-3:

Transactions Processing and Concurrency Control – Transaction Concept, Transaction model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability. Object Relational Data Models – Complex Data Types, Inheritance, Nesting and Unnesting.

MODULE-4:

NoSQL Databases – NoSQL Data Models, Comparisons of various NoSQL Databases. CAP Theorem, Storage Layout, Query models. Key-Value Stores. Document-databases – Apache CouchDB, MongoDB. Column Oriented Databases – Google's Big Table, Cassandra.

MODULE-5:

Advanced Application Development – Connecting to MongoDB with Python, MongoDB query Language, Updating/Deleting documents in collection, MongoDB query operators. MongoDB and Python patterns – Using Indexes with MongoDB, GeoSpatial Indexing, Upserts in MongoDB. Document database with Web frameworks.

Text Books

1. Ramesh Elmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education India, 2008.
2. Silberschatz A, Korth H F and Sudharshan S, "Database System Concepts", Sixth Edition, Tata McGraw-Hill Publishing Company Limited, 2010.

Reference Books

1. Niall O'Higgins, "MongoDB and Python", O'reilly, 2011.
2. Hector Garcia-Molina, Jeff Ullman and Jennifer Widom, "Database Systems: The Complete Book", Pearson, 2011.
3. Raghu Ramakrishnan and Johannas Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
4. Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management", Springer Verlag 2019.

Course Outcomes

CO1: Analyze the design of RDBMS and its internals

CO2: Apply algorithms for query processing and optimization

CO3: Apply transaction processing and concurrency control techniques for real-world applications.

CO4: Apply the design of Object relational, Graph and NoSQL databases for real-world applications

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED COMPUTER NETWORKS (PROFESSIONAL ELECTIVE-I)	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Computer Networks

Course objectives:

This course is aimed at enabling the students to

1. The course is aimed at providing basic understanding of Computer networks starting with OSI
2. Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
3. Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
4. Provide the mathematical background of routing protocols.
5. Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

Module 1: Network layer

Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, congestion control algorithms :Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

Module 2: Internetworking and IP protocols

How networks differ, How networks can be connected, internetworking, tunneling, The network layer in the internet,IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6 , Internet Control Protocols-IMCP, ARP, DHCP

Module 3: Transport Layer Protocols

Introduction, Services, Port numbers, User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

Module 4: Wireless LANS

Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers Other Wireless Networks: WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation

(3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

Module 5: Emerging trends in Computer networks

Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security.

Wireless Sensor Networks: WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design , Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features,P2P Networks: Characteristics of P2P Networks, Classification of P2P systems, Gnutella, BitTorrent, Session Initiation Protocol(SIP), Characteristics and addressing, Components of SIP, SIP establishment, SIP security.

Course Outcomes:

After the completion of the course, student will be able to

1. Illustrate reference models with layers, protocols and interfaces.
2. Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6.
3. Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.
4. Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks
5. Describe the emerging trends in networks-MANETS and WSN

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

Reference Books:

1. Networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	CLOUD COMPUTING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. A course on “Computer Networks”.
2. A course on “Operating Systems”.
3. A course on “Data base management systems"

Course objectives:

The Student will:

1. Understand the fundamentals of the Cloud Computing and strategies in the New Economy.
2. Provide a fundamental understanding of different types of cloud computing applications.
3. Provide insights to implement virtualization techniques.
4. Understand the design of cloud and its architecture.
5. Outlines the categories and multimedia in Cloud Computing.

Module 1:

Principles of Parallel and Distributed Computing, Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies

Cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and Mapreduce.

Module 2:

Cloud Platforms in the Industry, Understanding Scientific Applications for Cloud Environments, cloud applications. Healthcare and education, Scientific Applications, Business and Consumer Applications.

Module 3:

Virtualization, cloud virtualization technology, deep dive: cloud virtualization, migrating in to cloud computing. Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems.

Module 4:

Enterprise cloud computing Paradigm, Federated cloud computing Architecture.

SLA Management in Cloud Computing, Developing the cloud: cloud application Design.

Module 5:

Cloud management, Organizational Readiness and change management in the cloud age, Cloud Security, Data security in the cloud.

Legal Issues in the Cloud , Achieving Production Readiness for the cloud Services.

Text Books:

1. Cloud Computing: Raj Kumar Buyya , James Broberg, andrzejGoscinski, 2013 Wiley.
2. Cloud computing: Dr Kumar Saurab Wiley India 2011.

Reference Books:

1. Cloud Computing: ArshdeepBahga, Vijay Madisetti, 2014, University Press.
2. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola,selvi-2013.

E - Resources:

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf
3. https://www.alljntuworld.in/download/cloud-computing-cc-materials-notes/
4. https://www.slideshare.net/jeetraj17/cloud-computing-it703-Module-1-5

Course outcomes:

The Student will be able to:

1. Identify different elements of cloud computing.
2. Examine the essential processes of a Cloud Computing system.
3. Analyze the impact of Cloud Computing on organizations and strategy.
4. Learns the various marketing strategies for an online business.
5. Explain the infrastructure and multimedia concepts.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED SOFTWARE ENGINEERING (PROFESSIONAL ELECTIVE- II)	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Principles of Programming, Software Engineering

Course objectives:

1. To understand the rationale for software development process models
2. To understand why the architectural design of software is important;
3. To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
4. To understand the basic notions of a web service, web service standards, and serviceoriented architecture;
5. To understand the different stages of testing from testing during development of a software System

Module 1: SOFTWARE PROCESS &MODELING

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modeling – Principles – Requirements Engineering – Scenario-based Modeling – Class-based Modeling – Functional Modeling – Behavioral Modeling.

Module 2: SOFTWARE DESIGN

Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – PatternBased Design.

Module 3: SYSTEM DEPENDABILITY AND SECURITY

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design

Module 4: SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING

Service-oriented Architecture – RESTful Services – Service Engineering – Service Composition – Systems Engineering – Sociotechnical Systems – Conceptual Design – System Procurement – System Development – System Operation and Evolution – Real-time Software Engineering – Embedded System Design – Architectural Patterns for Real-time Software – Timing Analysis – Real-time Operating Systems.

Module 5: SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

COURSE OUTCOMES:

The Students will be able to

1. Identify appropriate process models based on the Project requirements
2. Understand the importance of having a good Software Architecture.
3. Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
4. Understand the basic notions of a web service, web service standards, and service oriented architecture;
5. Be familiar with various levels of Software testing

TEXT BOOKS

1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.

REFERENCES:

1. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018
2. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, NarosaPublishing House, 2018
3. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	CRYPTOGRAPHY & NETWORK SECTURITY (PROFESSIONAL ELECTIVE-I)	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. A Course on "Computer Networks

Course objectives:

1. To impart knowledge on network security issues, services, goals and mechanisms.
2. To analyze the security of communication systems, networks and protocols.
3. To apply algorithms used for secure transactions in real world application
4. To understand the email privacy and IP security.
5. Gain knowledge about web security protocols and intruders, threats, firewalls

Module 1:

Security Attacks (Interruption, Intercepion, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms.

A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module 2:

Conventional Encryption: Principles, Conventional encryption algorithms (DES, AES, RC4, Blowfish), cipher block modes of operation, location of encryption devices.

Key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

Module 3:

Number Theory: Modular Arithmetic, Euclid"s Algorithm, Fermat"s and Euler"s Theorem, Chinese Remainder Theorem, Public key cryptography principles.

Public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Module 4:

Email privacy: Pretty Good Privacy (PGP) and S/MIME.

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module 5:

Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Intruders, Viruses and related threats, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.

Text Books:

1. "Cryptography and Network Security" by William Stallings 3rd Edition, Pearson Education.
2. "Applied Cryptography" by BruceSchneier 2ndEdition,Wiley Publisher.

References:

1. Cryptography and Network Security by Behrouz A.Forouzan, 2nd edition, Tata McGraw- Hill Education.

Course outcomes:

Students will be able to:

1. Demonstrate the knowledge of cryptography and network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.
4. Implement the privacy to message transmission by providing IP security.
5. Analyze about web security protocols and intruders, threats, firewalls

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	DATA SCIENCE (PROFESSIONAL ELECTIVE-I)	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-requisite:

Good mathematical background and programming skills.

Course Objectives:

The students will

1. To explain how math and information sciences can contribute to building better algorithms and software.
2. To develop fundamental knowledge of concepts underlying data science projects.
3. To develop applied experience with data science software, programming, applications and processes.
4. To develop practical data analysis skills, which can be applied to practical problems.
5. To develop practical skills needed in modern analytics.

Module 1: Introduction to Data Science

What is Data Science? - Big Data VS Data Science, Datafication, Current landscape of perspectives and Skill sets needed.

Module 2: Statistics in Data Science

Statistical Inference, Populations and samples, Statistical modeling, probability distributions, fitting a model.

Module 3: Exploratory Data Analysis

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process.

Module 4: Liner Regression for Data Science

Simple Linear Regression, Multiple Linear Regression, other Considerations in the Regression Model,

Module 5: Classification

An Overview of Classification, Why Not Linear Regression?, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods.

Text Books:

1. Practical Data Science with R". Nina Zumel, John Mount. Manning, 2014.

Reference Books:

1. Data Science for business", F. Provost, T Fawcett, 2013.

E-Resources:

https://www2.cs.duke.edu/courses/compsci190/fall18

Course Outcomes:

The students will able to

1. Know basic notions and definitions in data analysis.
2. Know standard methods of data analysis
3. Understand and Apply Statistical Methods for Data Analysis.
4. formulate the problem of knowledge extraction.

5. translate a real-world problem into mathematical terms.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				M. Tech-CSE I Year- I / I Sem
Course Code:	ADVANCED DATA STRUCTURES LAB	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Programming for Problem Solving, Data Structures

Course objectives:

1. Introduces the basic concepts of Abstract Data Types.
2. Reviews basic data structures such as stacks and queues.
3. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
4. Introduces sorting and pattern matching algorithms.

PROGRAMS LIST

1. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
2. Write a program for implementing the following sorting methods:
   a) Merge sort b) Heap sort c) Quick sort
3. Write a program to perform the following operations:
   a) Insert an element into a B- tree.
   b) Delete an element from a B- tree.
   c) Search for a key element in a B- tree.
4. Write a program to perform the following operations:
   a) Insert an element into a Min-Max heap
   b) Delete an element from a Min-Max heap
   c) Search for a key element in a Min-Max heap
5. Write a program to perform the following operations:
   a) Insert an element into a Lefiist tree
   b) Delete an element from a Leftist tree
   c) Search for a key element in a Leftist tree
6. Write a program to perform the following operations:
   a) Insert an element into a binomial heap
   b) Delete an element from a binomial heap.
   c) Search for a key element in a binomial heap
7. Write a program to perform the following operations:
   a) Insert an element into a AVL tree.
   b) Delete an element from a AVL search tree.
   c) Search for a key element in a AVL search tree.
8. Write a program to perform the following operations:
   a) Insert an element into a Red-Black tree.
   b) Delete an element from a Red-Black tree.
   c) Search for a key element in a Red-Black tree.
9. Write a program to implement all the functions of a dictionary using hashing.
10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.
11. Write a program for implementing Brute Force pattern matching algorithm

12. Write a program for implementing Boyer pattern matching algorithm

TEXT BOOKS:

1. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M. Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data structures: A Pseudocode Approach with C, R.F. Gilberg And B.A. Forouzan, 2nd Edition, Cengage Learning

COURSE OUTCOMES:

1. Ability to select the data structures that efficiently model the information in a problem.
2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.
3. Implement and know the application of algorithms for sorting and pattern matching.
4. Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED OPERATING SYSTEMS LAB	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Operating Systems, C Programming

Programs List:

1. Write a program to create a child process using fork(). Print the process IDs of the parent and child and demonstrate the life cycle of a process.
2. Write a program to demonstrate the different process states (Running, Sleeping, Zombie) using Linux commands and system calls.
3. Write a program to handle UNIX signals like SIGINT and SIGTSTP using signal() or sigaction().
4. Implement a program to demonstrate IPC between parent and child processes using unnamed pipes.
5. Write a program to demonstrate synchronization using semaphores for the producer-consumer problem
6. Implement a program to copy a file from source to destination using open(), read(), write(), close()
7. Implement a queue-based simulation of a simple CPU scheduling algorithm (e.g., FCFS, Round Robin).
8. Implementation of Producer Consumer Problem with solution using Semaphores

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				M. Tech-CSE I Year- I / I Sem
Course Code:	ADVANCED ALGORITHMS	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

- A course on "Computer Programming & Data Structures"
- A course on "Advanced Data Structures & Algorithms"

Course objectives:

1. Introduces the recurrence relations for analyzing the algorithms
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms Introduces linear programming.

Module 1:

Introduction: Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time. Advanced Design and Analysis Techniques: Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

Module 2:

Greedy Algorithms - Huffman Codes, Activity Selection Problem. Amortized Analysis. Graph Algorithms: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.

Module 3:

Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, Sorting Network.

Matrix Operations- Strassen's Matrix Multiplication, Inverting matrices, Solving system of linear Equations

Module 4:

String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, KnuthMorris - Pratt algorithm.

Module 5:

NP-Completeness and Approximation Algorithms: Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Sales person problem.

TEXT BOOK:

1. Introduction to Algorithms," T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, Third Edition, PHI.

REFERENCE BOOKS:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia

publications pvt. Ltd.
2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R.Tomassia, John Wiley and sons.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.

Course outcomes:

Students will be able to:

1. Analyse the performance of various algorithms based on recurrence equation.
2. Apply the graphs and their traversals methods.
3. Implement major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Compare and analyse the various string matching algorithm and linear programming methods.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	MACHINE LEARNING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. A course on Linear Algebra and Advanced Calculus.
2. A course on "Probability and Statistics."
3. A course on "Data structures". Course Objectives

Course objectives:

The student will:

1. Use Models, methods and tools to solve regression, classification, feature selection, dimensionality reduction and density estimation problems.
2. Learn and adapt in supervised, unsupervised and semi-supervised modes of learning.
3. Gain knowledge of recognition, decision making and statistical learning problems.
4. Understand current research topics and issues in machine learning.
5. Conduct and present a literature review on a research topic.

Module 1: INTRODUCTION

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision treelearning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Module 2:

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neuralnetwork learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks.

EvaluationHypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

Module 3:

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximumlikelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning

Instance-Based Learning- Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning, Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Paralleling Genetic Algorithms

Module 4:

Learning Sets of Rules –Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

Module 5:

Combining Inductive and Analytical Learning –Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators,

Reinforcement Learning –Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming.

Text Books:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William whsieh, Cambridge Univ. Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern classification, John Wiley & Sons Inc., 2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Presss, 1995.

E - Resources:

1. https://www.slideshare.net/darshanharry/machine-learning-46440299
2. https://news.vidyaacademy.ac.in/wp- content/uploads/2018/10/NotesOnMachineLearningForBTech-1.pdf
3. https://nptel.ac.in/courses/106/106/106106202/

Course Outcomes

The Student will be able to:

1. Summaries on well posed problem, concept learning and various perspectives of machine learning
2. Apply machine learning algorithms such as Decision tree, Artificial Neural Networks to solve real world problems and formulate evaluation hypotheses.
3. Compare and contrast various machine learning methodologies such as Bayesian Learning, Computational learning theory, instance based learning and Genetic algorithms.
4. Implement rule based learning and analytical learning strategies to solve complex problems.
5. Combine inductive learning with analytical learning and deploy Reinforcement learning which supports dynamic programming

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	BIGDATA ANALYTICS	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Database Management Systems, Cloud Computing.

Course objectives:

The students should be able to

1. Understand the basics of Big Data and Big data Platform
2. Attain the knowledge of Big Data analytics, Approaches and Tools
3. Describe Map Reduce fundamentals and HDFC File system
4. Differentiate between Hadoop and RDBMS concepts
5. Apply analytics on Structured and Unstructured Data

Module 1:

Big Data Analytics: What is big data, History of Data Management ; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data;

Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools

Module 2:

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics;

Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

Module 3:

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop

Introduction of HDFS: Architecture, HDFC Files, File system types, commands, org.apache.hadoop.io package, HDF, HDFS High Availability; Introducing HBase

Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS

Module 4:

Big Data Technology Landscape and Hadoop : NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors;

HDFC (Hadoop Distributed File System): HDFC Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN

Module 5:

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools

Text Books

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black BookTM , DreamTech Press, 2015 Edition.
3. BUSINESS ANALYTICS 5e , BY Albright |Winston

Reference Books

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss,ShakuAtre, " Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, " Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

E-Resources

1. https://www.coursera.org/learn/big-data-introduction
2. https://www.tutorialspoint.com/big_data_analytics/index.htm
3. www.upgrad.com/Big-Data
4. https://www.javatpoint.com/what-is-big-data
5. https://www.edx.org/course/big-data-analytics-using-spark

Course Outcomes

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

CO1. Identify the basics of Big Data and its environment

CO2. Use Big Data analytics Tools and its Approaches

CO3. Define Map Reduce fundamentals and HDFC Architecture

CO4. Distinguish between Hadoop and RDBMS concepts

CO5. Illustrate analytics on Structured and Unstructured Data.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				
		M. Tech-CSE I Year- I / I Sem			
Course Code:	WIRELESS SENSOR NETWORKS	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Computer Networks

Course objectives:

1. To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
2. To study the various protocols at various layers and its differences with traditional protocols.
3. To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Module 1:

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Module 2:

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Module 3:

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

Module 4:

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Module 5:

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Text Book

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.

Reference Book

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education - 2004

Course Outcomes

- Technical knowhow in building a WSN network.
- Analysis of various critical parameters in deploying a WSN

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	COMPUTER VISION	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Course objectives:

The student will:

1. Review image processing techniques for computer vision
2. Understand shape and region analysis
3. Understand Hough Transform and its applications to detect lines, circles, ellipses
4. Understand three-dimensional image analysis techniques
5. Understand motion analysis

Module 1: IMAGE PROCESSING FOUNDATIONS

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

Module 2: SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

Module 3: HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of- normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location– GHT for feature collation

Module 4: 3D VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion

Module 5: APPLICATIONS

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

Text Books:

1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

Reference Books:

1. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer2011.
2. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
5. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.

Course Outcomes

The Student will be able to:

1. Implement fundamental image processing techniques required for computer vision Perform shape analysis
2. Implement boundary tracking techniques
3. Apply chain codes and other region descriptors
4. Apply Hough Transform for line, circle, and ellipse detections 6.Apply 3D vision techniques
5. Implement motion related techniques Develop applications using computer vision techniques

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	HIGH PERFORMANCE COMPUTING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. Computer Organization &Architecture 2.Operating System Programming

Course objectives:

1. Improve the system performance
2. Learn various distributed and parallel computing architecture
3. Learn different computing technologies

Module 1:

Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm).

Module 2:

Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.

Module 3:

Example Cluster System – Beowlf; Cluster Operating Systems: CompasAnd Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.

Module 4:

Device Connectivity; Java For Pervasive Devices; Application Examples.

Module 5:

Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin&Toffoli Gates; Quantum Circuits; Quantum Algorithms.

Text Books:

1. Selected Topics In Advanced Computing" Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education

Reference Books:

1. J. Joseph & C. Fellenstien: „Grid Computing „, Pearson Education
2. J. Burkhardt et.al: „pervasive computing" Pearson Education
3. Marivesar:" Approaching quantum computing", pearson Education.
4. Raj kumarBuyya:"High performance cluster computing", pearson Education.
5. Neilsen &ChungL:"Quantum computing and Quantum Information", Cambridge University Press.
6. A networking approach to Grid Computing ,Minoli ,Wiley E - Resources:

Course Outcomes

The Student will be able to:

1. Understanding the concepts in grid computing
2. Set up cluster and run parallel applications
3. Understand the cluster projects and cluster OS
4. Understand the concepts of pervasive computing & quantum computing.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				
		M. Tech-CSE I Year- I / I Sem			
Course Code:	INTERNET OF THINGS	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Course objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of M2M (machine to machine) with necessary protocols
3. To introduce the Python Scripting Language which is used in many IoT devices
4. To introduce the Raspberry PI platform, that is widely used in IoT applications
5. To introduce the implementation of web based services on IoT devices

Module 1:

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

Module 2:

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Module 3:

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

Module 4:

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Module 5:

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Course Outcomes:

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Appraise the role of IoT protocols for efficient network communication.
4. Elaborate the need for Data Analytics and Security in IoT.
5. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	FOG AND EDGE COMPUTING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-**Requisites**:

Computer Networks

Course objectives:

1. To understand the students about edge computing, an important branch of distributed computing and IoT with significant applications in Data Science.
2. To implement the concepts of fog and cloud computing and exposes students to modern tools and API to deploy relevant infrastructures.

Module 1:

Fog computing requirements when applied to IoT: Scalability, Interoperability, FogIoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modelling Technique re by Use-Case Scenarios , Integrated C2F2T Literature by Metrics.

Module 2:

Exploiting Fog Computing in Health Monitoring : An Architecture of a Health Monitoring IoTBased System with Fog Computing , Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction , Data-Driven Intelligent Transportation Systems, Fog Computing for Smart Transportation Applications Case Study: Intelligent Traffic Lights Management (ITLM) System

Module 3:

Software Defined Networking and application in Fog Computing: Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber- Physical Energy Systems over Fog Computing

Module 4:

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M.

Module 5:

IoT Architecture and Core IoT Modules-A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with the examples- Edge computing with RaspberryPi, Industrial, and Commercial IoT and Edge, and Edge computing and solutions.

Course Outcomes:

1. Explore the need for new computing paradigms.
2. Explain the major components of fog and edge computing architectures.
3. Identify potential technical challenges of the transition process and suggest solutions.
4. Analyze data and application requirements and pertaining issues.

5. Design and model infrastructures.

Textbooks:

1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya
2. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
3. 3Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc.,
4. 2019, ISBN: 978149204322
5. David Jensen, “Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	RESEARCH METHODOLOGY AND IPR	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

NIL

Course objectives:

The student will:

1. To understand the basic concept of research problem formulation.
2. To be exposed to effective research report writing and research design.
3. To investigate the various methods of data collection and analysis.
4. To understand the various fields of Industrial Property and PCT.
5. To be exposed to administration of IP and new developments in IPR.

Module 1:

Introduction

Meaning and Objectives of Research, Types of Research, Research Approaches, Research Methods Vs Methodology, Research Process, Criteria of Good Research.

Research Problem

Meaning of Research Problem, Steps involved in Selecting a Research Problem, Scope and Objectives of Research Problem, Sources of Research Problem, Characteristics of a Good Research Problem, Steps involved in Defining a Research Problem.

Module 2:

Effective technical writing

Importance of Literature Review, Steps involved in conducting a Literature Review, Research Report, Characteristics of a Good Report, Layout of a Research Report, writing a Journal Paper, Writing a Research Proposal, Format of Research Proposal, Plagiarism and Research Ethics.

Research Design Need for Research Design, features of a Good Design, Important Concept Relating to Research Design, Categories of Research Design, Design Thinking Approach

Module 3:

Data Collection

Methods of Primary Data Collection – Observation Method, Interview Method, Collection of Data through Questionnaire and Schedule, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Data Processing and Analysis Processing Operations, Problems in Processing, Types of Analysis, Multivariate Analysis, Correlation Analysis, Regression Analysis

Module 4:

Test Procedures:

Fields of Intellectual Protection

Patents - Conditions of Patentability, Drafting and Filing a Patent Application, Examination of a patent Application; Copyright - Copyright Protection, Subject Matter of Copyright Protection, Ownership of Copyright, Limitations on Copyright Protection; Trademarks - Definitions, Criteria of Protect ability, Protection of Trademark Rights; Industrial Designs; Geographical Indications.

International cooperation on intellectual property

World Intellectual Property Organization (WIPO) - Patenting under PCT; Patent information and databases; Licensing and transfer of technology.

Module 5:

Administration of Industrial Property

Administrative Structure in the Industrial Property Office, Patent Office, Trademark Office, Industrial Designs Office, Patent and Trademark Attorney.

New Developments in IPR

Technological and Legal Developments in IntellectualProperty, Traditional Knowledge, Case Studies.

Text Books:

1. Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & Engineering Students"", Juta& Co. Ltd Publishers, Revised Second Edition, 2006.
2. Halbert, "Resisting Intellectual Property", Routledge, Taylor & Francis Ltd, First Edition, 2007.
3. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publications, Revised Second Edition, 2004.

REFERENCE BOOKS:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", British Library Publishers, Fourth Edition, 2014.
2. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Wolters Kluwer Law & Business Publishers, 2016.
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand Publications, First Edition, 2008.

E - Resources:

https://www.coursera.org/learn/research-methods

https://onlinecourses.nptel.ac.in/noc19_ge21/preview

https://www.edx.org/course/research-methods-an-engineering-approach

https://en.wikipedia.org/wiki/Intellectual_property

https://nptel.ac.in/courses/109/106/109106137/

Course Outcomes

The Student will be able to:

1. Understand the basic concept of research problem formulation.
2. Develop an effective research proposal and research report.
3. Identify appropriate method for data collection and analysis for effective research.
4. Apply for Patent Filing and other fields of IP.
5. 5Make use of new developments in IPR.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	ADVANCED ALGORITHMS LAB	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Course objectives:

1. Recognize the recurrence relations for analysing the algorithms
2. Illustrate the working of graphs and their traversals.
3. Explain major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Compare different algorithms using worst-case, average-case and best-case analysis.
5. Understand the string matching algorithm and linear programming.

List of Experiments:

1. Implement assignment problem using Brute Force method
2. Perform multiplication of long integers using divide and conquer method.
3. Implement solution for knapsack problem using Greedy method.
4. Implement Gaussian elimination method.
5. Implement LU decomposition
6. Implement Warshall algorithm
7. Implement Rabin Karp algorithm.
8. Implement KMP algorithm.
9. Implement Harspool algorithm
10. Implement max-flow problem.

Course outcomes:

Students will be able to:

1. Analyse the performance of various algorithms based on recurrence equation.
2. Apply the graphs and their traversals methods.
3. Implement the major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.
4. Evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Compare and analyse the various string matching algorithm and linear programming methods.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	MACHINE LEARNING LAB	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. A course on Linear Algebra and Advanced Calculus.
2. A course on "Probability and Statistics."
3. A course on "Data structures". Course Objectives

Course objectives:

The student will:

1. Use Models, methods and tools to solve regression, classification, feature selection, dimensionality reduction and density estimation problems.
2. Learn and adapt in supervised, unsupervised and semi-supervised modes of learning.
3. Gain knowledge of recognition, decision making and statistical learning problems.
4. Understand current research topics and issues in machine learning.
5. Conduct and present a literature review on a research topic.

List of Experiments

1. Experiment 1: Familiarizing with Ananconda and Jupyter, for importing modules and dependencies for ML
2. Experiment 2: Familiarization with numpy, Panda and Matplotlib by Loading Dataset in Python.
3. Experiment 3:Familiarization with Pytorchin Python.
4. Experiment 4: Find S algorithm in Python
5. Experiment 5: Candidate Elimination Algorithm in Python
6. Experiment 6: ID3 Algorithm for Decision Tree in Python
7. Experiment 7: C4.3 Algorithm for Decision Tree in Python.
8. Experiment 8: Demonstration of Logistic Regression using Python.
9. Experiment 9: Demonstration of Classification using Python.
10. Experiment 10: Demonstration of Clustering using Python.
11. Experiment 11: Implementation of Bayesian Network in Python.
12. Experiment 12: Implementation of SVM using Python.
13. Experiment 13: Implementation of XOR function using NN and Python.
14. Experiment 14: Implementation of Backpropagation using Python.
15. Experiment 15: Implementation of Autoencoder in python.
16. Experiment 16: Sentiment Analysis using "Bag of Words" in Python
17. Experiment 17: Recommender System in Python.

Text Books:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

Reference Books:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William whsieh, Cambridge Univ. Press.
2. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern classification, John Wiley & Sons Inc., 2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Presss, 1995. Course Outcomes

Course Outcomes

The Student will be able to:

1. Summarize the well posed problem, concept learning and various perspectives of machine learning
2. Apply machine learning algorithms such as Decision tree, Artificial Neural Networks to solve real world problems and formulate evaluation hypotheses.
3. Compare and contrast various machine learning methodologies such as Bayesian Learning, Computational learning theory, instance based learning and Genetic algorithms.
4. Implement rule based learning and analytical learning strategies to solve complex problems.
5. Combine inductive learning with analytical learning and deploy Reinforcement learning which supports dynamic programming.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	PERSONALITY DEVELOPMENT AND PROFESSIONAL VALUES	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

NIL

Course objectives:

The student will:

1. Study the sensitization towards gender equality, physically challenged, intellectually challenged.
2. Summarize the Leadership and qualities of a successful leader.
3. Explain the Modern Challenges of Adolescent Emotions and behaviour.
4. Describe the Personality Development Body language.
5. Study the Workplace Rights & Responsibilities.

Module 1:

Concept of Human Values, Value Education Towards Personal Development

Aim of education and value education; Evolution of value-oriented education; Concept of Human values; types of values; Components of value education.

Personal Development: Self-analysis and introspection; sensitization towards gender equality, equitability, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.

Character Formation Towards Positive Personality: Truthfulness, Constructively, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.

Module 2:

Aspects of Personality Development -Body language- Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work s - Positive attitude – Advantages –Negative attitude- Disadvantages– Time management - Work ethics –Good manners and etiquette.

Module 3:

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

Module 4:

Workplace Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Module 5:

Impact of Global Development on Ethics and Values Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges, and compromise. Defining the difference between aggressive, submissive, and assertive behaviours.

Modern Challenges of Adolescent Emotions and behaviour; Sex and spirituality: Comparison and competition; positive and negative thoughts. Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

Course Outcomes

The Student will be able to:

1. Describe the sensitization towards gender equality, physically challenged, intellectually challenged.
2. Explain the Leadership and qualities of a successful leader.
3. Discuss the Modern Challenges of Adolescent Emotions and behaviour.
4. Illustrate the Personality Development Body language.
5. Identify the Workplace Rights & Responsibilities.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				M. Tech-CSE I Year- I / I Sem
Course Code:	DEEP LEARNING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Probability Statistics, linear algebra. Machine learning.

Course objectives:

The students should be able to

1. Get introduced to various learning techniques of machine learning and understand differences between machine learning and deep learning
2. Understand and analyse optimization techniques and improvements in learning methods
3. Appreciate, understand and apply neural networks as tools for complete learning problems
4. Investigate and deploy/club multi-layer neural networks for learning related to images, text and speech sequences.
5. Appreciate, understand and implement Deep learning in real world practical problems.

Module 1:Introduction to Deep Learning

Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning. Bayesian Learning, Decision Surfaces, Success stories of Deep Learning

Module 2: Linear Classifiers

Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

Module 3: Neural Network

Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks, NN in python

Module 4: Deep Neural Net

Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, CNN in Python

Module 5: Applications of Deep Learning

Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection, Generative Modelling with Deep Learning, Variation Auto encoder, Generative Adversarial Network, Object recognition with Python.

Text Books

1. Deep Learning- Ian Goodfelllow, YoshuaBenjio, Aaron Courville, The MIT Press
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

Reference Books

1. Deep Learning: A Practitioner's Approach by Josh Patterson & Adam Gibson, OReilly Press
2. Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow, 2nd Edition by Ivan Vasilev, Pakt Publication.

E-Resources

1. https://nptel.ac.in/courses/106/105/106105215/
2. https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction
3. https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf

Course Outcomes

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

1. CO1. Identify tools of machine learning and deep learning, appropriate to any problems
2. CO2. Apply optimization techniques to improve the quality of various learning solutions
3. CO3. Apply and investigate, neural network for complete learning problems.
4. CO4. Deploy deep learning methods in the area of multidimensional and sequential inputs
5. CO5. Investigate the scope of implementation of various deep learning techniques in any real world problem.

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)				
		M. Tech-CSE I Year- I / I Sem			
Course Code:	BLOCKCHAIN TECHNOLOGY	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

Course objectives:

The student will:

1. Learn the fundamentals of BlockChain Technology
2. Understand the History of Money and working with Bitcoin
3. Understand usage of cryptography in Block Chain Technology
4. Create smart account and decentralized Systems.

Module 1:

Introduction: History, what is blockchain, the structure of block chains, types of block chain, block chain applications, block chain lifecycle. Limitations and challenges of blockchain.

Module 2:

Crypto currencies: Cryptography, the science behind crypto currencies, Symmetric key cryptography, cryptography hash functions, MAC and HMAC, asymmetric key cryptography Diffie-Hellman key exchange, symmetric versus asymmetric key cryptography, game theory Nash equilibrium, prisoners dilemma, byzantine Generals' problem, zero-sum games.

Module 3:

Bitcoin: History of Money, working with Bitcoins, the Bitcoin Blockchain, Bitcoin network, bitcoin scripts, Full nodes vs SPVs, Bitcoin wallets.

Module 4:

Ethereum: Ethereum as Next-Gen Blockchain, Design Philosophy of Ethereum, Ethereum Blockchain, Ethereum Accounts, Trie Usage, RLP Encoding, Ethereum Transaction Message structure, Ethereum smart contracts, Ethereum Virtual Machine, Ethereum Eco System.

Module 5:

Block chain application development, Interacting with bitcoin blockchain, interacting programmatically with ethereum for sending transactions, creating smart account, executing smart contract functions, decentralised application structure. Building an ethereumDapp

Text Books:

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Bikramaditya Singhal, Gautam Dhameja ,Priyansu Sekhar Panda.
2. Blockchain Technology Explained: The Ultimate Beginner‟s Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple,Dash

REFERENCE BOOKS:

1. Blockchain Technology: Introduction to Blockchain Technology and its impact on Business Ecosystem
2. Blockchain: Bitcoin, Ethereum & Blockchain: Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency
3. Blockchain: Discover the Technology behind Smart Contracts, Wallets, Mining and Cryptocurrency.

Course Outcomes

The Student will be able to:

1. Understated the block chain Technology andlimitations
2. Analyse the history of money and working with Bitcoin and Bitcoin wallets
3. Use cryptography in bitcoin transactions
4. Understand the Design philosophy of Block Chain Technology and Virtual Machine
5. Develop Decentralized applications and BuildingethereumDapp

AY: 2024-25 Onwards	J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (UGC Autonomous)	M. Tech-CSE I Year- I / I Sem			
Course Code:	QUANTUM COMPUTING	L	T	P	D
Credits: **3**		**3**	**0**	**0**	**0**

Pre-Requisites:

1. Knowledge on "Machine Learning".
2. Knowledge on "Probability and Statistics".

Course objectives:

The Student will:

1. Interpret the fundamentals of quantum computing.
2. Know the how quantum Mechanics is applied in quantum computing.
3. Illustrate the Quantum information with architecture and algorithms.
4. Develop the quantum programming languages.
5. Explain the current status of quantum computing.

Module 1:

Introduction to Basic quantum Mathematics

Complex numbers and its geometrical representations, Complex vector spaces, inner products and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces.

Module 2:

Basic Quantum Mechanics

Deterministic Systems, Probabilistic descriptions and Quantum systems, Basics of Quantum theory, Schrodinger‟s time dependent equation, Wave nature of Particles, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states, entanglement.

Module 3:

Quantum Information

Bits and Qubits, Classical gates versus quantum gates, Deutsch‟s Algorithm, Deutsch-Jozsa Algorithm, Simon‟s periodicity algorithm, Grover‟s search algorithm, Shor‟s Factoring algorithm

Module 4:

Quantum Programming

Quantum programming languages, Probabilistic and Quantum computations, introduction to quantum cryptography and quantum information theory.

Module 5:

Current Status of Quantum Computing

Multi Qubit Systems, why are qubits superior, Quantum computing and Security, Sycamore processors, IBM Quantum Computer, Quantum Simulations.

Text Books:

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008.

Reference Books:

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008.
2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010.
3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995.

E - Resources:

1. http://patrickjmt.com/
2. https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
3. https://homes.cs.washington.edu/~oskin/quantum-notes.pdf
4. https://nptel.ac.in/courses/104/104/104104082/

Course outcomes:

The Student will be able to:

1. Understand the Basics of complex vector spaces.
2. Analyze Quantum mechanics as applied in Quantum computing.
3. Analyze the quantum information with Architecture and algorithms.
4. Apply the quantum programming languages.

5. Understand the current status of quantum computing.