HONOURS

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	23HRCSE1	Introduction to Quantum Computing	3	-	-	3	30	70	100
2	23HRCSE2	No SQL Databases	3	-	-	3	30	70	100
3	23HRCSE3	Software Defined Data Center	3	-	-	3	30	70	100
4	23HRCSE4	Robotics And Intelligent Systems	3	-	-	3	30	70	100
5	23HRCSE5	Cloud Security	3	-	-	3	30	70	100
6	23HRCSE6	No SQL Lab	-	-	3	1.5	30	70	100
7	23HRCSE7	Quantum & Cloud Computing Lab	-	-	3	1.5	30	70	100

23HRCSE1	**INTRODUCTION TO QUANTUM COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:
Upon successful completion of this course, students will be able to:

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover‘s, and Shor‘s.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra
Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits
Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity
Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover‘s Search Algorithm, Shor‘s Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms
Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Textbooks:

4. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
5. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

4. David McMahon, Quantum Computing Explained, Wiley, 2008.
5. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
6. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources:

1. **IBM Quantum Experience and Qiskit Tutorials**
2. **Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley**
3. edX – The Quantum Internet and Quantum Computers
4. **YouTube – Quantum Computing for the Determined by Michael Nielsen**
5. Qiskit Textbook – IBM Quantum

23HRCSE2	**No SQL DATABASES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Discuss the history unstructured data
- To know non- relational databases and their importance in Data science.
- Under stand the differences between Relational and No SQL databases
- To explore the several types of No SQL data bases and understand the role in Big Data.

Course Out comes:

After completion of the course, students will be able to

- Explain and compare different types of No SQL database.
- Compare and contrast RDBMS with different No SQL databases.
- Define, compare and use the four types of No SQL databases (Document-oriented, Key Value pairs, Column-oriented and Graph
- Demonstrate the architecture, define objects, load data, query data and performance tune Column-oriented, Key-Value pair, Document and Graph databases.
- Evaluate No SQL database development tools and programming languages

UNIT I Overview and history of No SQL Data bases Lecture 12Hrs

Definition of the four types of No SQL data bases. The value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The emergence of No SQL, Key Points.

UNIT II RDBMS Vs No SQL Lecture 12Hrs

Comparison of relational databases to new No SQL stores, Mongo DB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges No SQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregated-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 Document Data bases Lecture 12Hrs

No-SQL Key-Value Databases using Mongo DB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analysis or Real Time Analytics.

UNIT IV Column Oriented Databases Lecture 12Hrs

Column-oriented No SQL databases using Apache HBASE, Column-oriented No SQL 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 Key Value Data bases Lecture 12Hrs

No SQL Key-Value databases using Riak, Key-Value Data bases, Key-Value Store, Key-Value Store

Features, Consistency, Transactions, Query Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets, Firebase- Cloud hosted No SQL Database, Graph No SQL databases using Neo4j, No SQL database development tools and programming languages, Graph Databases features, consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text books:

1. Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition 2019.

Reference Books:

1. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the No SQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC.

ISBN-13: 978-1934356920 ISBN-10: 1934356921

2. Guy Harrison, Next Generation Database: No SQL and big data, Apress.

Online Learning Resources:

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

23HRCSE3	**SOFTWARE DEFINED DATA CENTER**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Introduce conventional Data Centers followed by Modern Data Centers
- To discuss various software elements of modern data centers
- Explain Virtualization concepts for Data Centers
- Discuss Compute, Storage and Network virtualization

Course Out comes:

After completion of the course, students will be able to

- Understanding of difference between Conventional Data Center Vs Modern Data Centers
- Differentiate Cloud computing and Software Defined Data Centers
- Differentiate Virtualization with conventional techniques
- Explore the techniques of Software Defined Compute, Storage and Networking components
- Able Manage Software Defined Data Centers and Develop the techniques for future Data Centers.

UNIT I Introduction Lecture 12Hrs

Data Center evolution, A history of Modern Data Center, Focus on cost reduction, Focus on Customer service in the business, Flattening of the IT organization, IT as an operational Expense, Monolithic Storage Array rise and fall, Move From Disk to Flash, Emergence of Convergence, The Role of Cloud computing.

UNIT II Emerging Data Center Trends Lecture 12Hrs

Emergence of SDCC, Commoditization of Hardware, Software Defined – Compute, Storage, Networking and Security, Software Defined Storage (SDS), Hyper convergence, Hyper Converged Infrastructure(HCI) and SDS relationship, Flash in Hyper convergence, Modern IT business Requirements.

UNIT III Data Center Agility Lecture 12Hrs

Principles and Strategies, Transform Data Center, Align Data Center and Business Needs, Server virtualization, VDI, Eliminate and Implement Monolithic to Hyper convergence, Full Stack Management.

UNIT V Hyper converged Infrastructure Lecture 12Hrs

Software Defined Storage, SDS comparison to Traditional Storage, SDS requirements, SDS in Hyper converged, Hyper convergence Design Model, Virtual Storage appliances, Appliance vs. Software/Reference Architecture,

UNIT V Future Data Centers Lecture 12Hrs

Data growth, Storage capacity, flash storage deployment, Deployment Experiences SDS and HCI, IT transformations- Automation, Orchestration, Dev Ops, Open Standards and Interoperability, Performance Benchmarking Standards, Future Trends, Containers Instead of virtual machines, Open Source tools, Beyond Today‘s Flash, Pooling of Resources.

Text books:

1. Building a Modern Data Center, Principles and Strategies of Design, Scott D.Lowe, James Green, David Davis. Actual Tech Media, 2016.

Reference Books:

1. Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center, Second Edition, HwaiyuGeng P.E.,2021 John Wiley & Sons.

23HRCSE4	**ROBOTICS AND INTELLIGENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand the basic concepts of robotics.
- Discuss the requirement of robotic technology
- Introduce robotics kinematics, dynamic analysis and programming.
- Understand the concepts of intelligent system and apply them to robotics

Course Out comes:

After completion of the course, students will be able to

- Understand general concepts of Robotics and intelligent systems.
- Understand robotics control systems
- Analyze and understand the various programming languages of robotics
- Understand Industrial robots and its applications
- Create IoT solutions using sensors, actuators and Devices

UNIT- I Lecture 8Hrs

Introduction to Robotics : Back ground, Historical development, Robot Arm Kinematics and Dynamics, Manipulator Trajectory planning and Motion Control, Robot Sensing

UNIT- II Lecture 9Hrs

Robot Arm Kinematics and Dynamics: Introduction to Kinematics, Direct and Inverse Kinematics Problem and solution, Dynamics introduction, Lagrange-Euler Formulation, Newton Euler Formation, Generalized D'Alembert Equations of motion. Trajectory planning,

UNIT- III Lecture 9Hrs

Sensing and Vision: Introduction to Sensing, Proximity Sensing, Touch Sensors, Force and Torque Sensing, Image acquisition, Illumination techniques, Imaging Geometry, Recognition and Interpretation.

UNIT IV Lecture 8Hrs

Robot Programming Languages: Introduction to Robot Programming Languages, Characteristics of Robot Level Languages, three levels of robot programming, requirements of a robot programming language, Task Level Languages, problems peculiar to robot languages, Introduction to Robot

Operating System (ROS)

UNIT V Lecture 8Hrs

Robot Intelligence: Introduction, State Space Search, Problem Reduction, Use of Predicate Logic, Means-Ends Analysis, Problem solving, Robot Learning, Robot Task Planning, Basic Problems in Task Planning, Expert systems and knowledge engineering.

Text books:

1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence

2. Aaron Martinez, Enrique Fernandez, Learning ROS for Robotics Programming: A practical, instructive, and comprehensive guide to introduce your self to ROS, the top-notch, leading robotics framework, PACKT publishing, Open Source.

Reference Books:

John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, Third Edition.

Online Learning Resources

https://nptel.ac.in/courses/107106090
https://nptel.ac.in/courses/112108298

23HRCSE5	**CLOUD SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre- requisites: Computer Networks, Cryptography and Network Security, Cloud Computing.

Course Objectives:

The course is designed to

- Under stand the cloud security and privacy issues.
- Familiarize with the Threat Model and Cloud Attacks.
- Understand the Data Security and Storage.
- Analyze Security Management in the Cloud

Course Out comes:

After completion of the course, students will be able to

- Distinguish the various cloud security and privacy issues.
- Analyze the various threats and Attack tools.
- Describe the Data Security and Storage.
- Analyze the Security Management in the Cloud

UNIT I Over view of Cloud Computing Lecture 9 Hrs

Overview of Cloud Computing: Introduction, Definitions and Characteristics, Cloud Service Models, Cloud Deployment Models, Cloud Service Platforms, Challenges Ahead. Introduction to Cloud Security: Introduction, Cloud Security Concepts, CSA Cloud Reference Model, NIST Cloud Reference Model, NIST Cloud Reference Model.

UNIT II Cloud Security and Privacy Issues Lecture 9 Hrs

Cloud Security and Privacy Issues: Introduction, Cloud Security Goals/Concepts, Cloud Security Issues, Security Requirements for Privacy, Privacy Issues in Cloud. Infrastructure Security: The Network Level, the Host Level, the Application Level, SaaS Application Security, PaaS Application Security, IaaS Application Security.

UNIT III Threat Model and Cloud Attacks Lecture 9 Hrs

Threat Model and Cloud Attacks: Introduction, Threat Model- Type of attack entities, Attack surfaces with attack scenarios, A Taxonomy of Attacks, Attack Tools-Network-level attack tools, VM-level attack tools, VMM attack tools, Security Tools, VMM security tools.

UNIT IV Data Security and Storage Lecture 9Hrs

Information Security Basic Concepts, an Example of a Security Attack, Cloud Software Security Requirements, Rising Security Threats. Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.

UNIT V Security Management in the Cloud Lecture 9 Hrs

Evolution of Security Considerations, Security Concerns of Cloud Operating Models, Identity Authentication, Secure Transmissions, Secure Storage and Computation, Security Using Encryption Keys, Challenges of Using Standard Security Algorithms, Variations and Special Cases for Security Issues with Cloud Computing, Side Channel Security Attacks in the Cloud. Security Management in the Cloud- Security Management Standards, Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.

Text books:

1. Preeti Mishra, Emmanuel S Pilli, Jaipur R C Joshi Graphic Era., ―Cloud Security Attacks, Techniques, Tools, and Challenges‖, 1st Edition, 2022, CRC press.
2. Tim Mather, SubraKumaraswamy, and ShahedLati―Cloud Security and Privacy‖,1st Edition, 2019, O'Reilly Media, Inc.

Reference Books:

1. Naresh Kumar Sehgal Pramod Chandra, P. Bhatt John M. Acken., ―Cloud Computing with Security Concepts and Practices‖, 2nd Edition Springer nature Switzerland AG 2020.
2. Essentials of Cloud Computing by K. Chandrasekaran Special Indian Edition CRC press.
3. Raj kumar Buyya,―Cloud Computing Principles and Paradigms‖, John Wiley.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_cs64/preview
- https://archive.nptel.ac.in/courses/106/105/106105167/

23HRCSE6	**No SQL Lab**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Outcomes:

Upon successful completion of the course, the student will be able to:

List of Experiments:

1. Mongo DB installation and configuration in windows.
2. Demon strate how to create and drop a database in Mongo DB.
3. Creating the Collection in Mongo DB on the fly
4. Creating collection with options before inserting the documents and drop the collection created.
5. Mongo DB insert document
    a. Insert single document
    b. Insert multiple documents in collection
6. Querying all the documents in json format and Querying based on the criteria.
7. Mongo DB update document
    a. Using update() method.
    b. Using save() method.
8. MongoDB delete document from a collection.
    a. Using remove() method.
    b. Remove only one document matching your criteria
    c. Remove all documents
9. Mongo DB Projection
10. limit() ,skip(), sort() methods in Mongo DB
11. Mongo DB indexing
    a. Create index in Mongo DB
    b. Finding the indexes in a collection
    c. Drop indexes in a collection
    d. Drop all the indexes
12. Mongo DB with java and PHP
    a. Create a simple application that uses Mongo DB with Java
    b. Create a simple application that uses Mongo DB with PHP

Web References:

23HRCSE7	**QUANTUM & CLOUD COMPUTING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives (COs)

This course aims to:

1. Introduce fundamental quantum computing concepts such as qubits, superposition, and quantum gates using Qiskit.
2. Develop an understanding of quantum algorithms through practical implementation, including Deutsch's algorithm.
3. Provide hands-on experience in cloud computing by simulating cloud environments, VM allocation, and scheduling policies.
4. Analyze cloud resource management techniques such as load balancing and deployment models.
5. Explore cloud security challenges by simulating cyber threats like Denial of Service (DoS) attacks.

Course Out comes (CLOs)

By the end of this course, students will be able to:

1. Implement and compare classical and quantum bits using Qiskit.
2. Design and analyze quantum circuits using logic gates and linear algebra principles.
3. Simulate and evaluate cloud computing infrastructures including data centers, VM allocation, and scheduling policies.
4. Apply resource provisioning techniques to optimize cloud performance and load balancing.
5. Assess cloud security threats by implementing and analyzing DoS attack simulations.

Quantum Computing Lab:

1. **Simulating Classical vs Quantum Bits**
   - Implement **classical bits and qubits** using Qiskit.
   - Compare **bit flip** vs **quantum superposition** using Hadamard gates.
2. **Quantum Logic Gates Implementation**
   - Implement and visualize basic **quantum gates** (X, Y, Z, H, S, T).
   - Apply these gates to single and multiple qubits.
3. **Linear Algebra in Quantum Computing**

   - Represent **quantum states** using matrices and vectors.
   - Perform **matrix operations** (addition, multiplication, tensor product).

4. **Deutsch's Algorithm Implementation**

   - Demonstrate quantum parallelism using **Deutsch's algorithm**. Compare results with classical computation.

Cloud Computing Lab:

1. S**imulation of a Simple Cloud Data Center**: Create a cloud environment with multiple **Hosts, Virtual Machines (VMs), and Cloudlets**.
2. **VM Allocation and Scheduling Policies**: Implement and compare **Time-Shared and Space-Shared** VM allocation policies.
3. **Resource Provisioning and Load Balancing** : Simulate dynamic **resource allocation** for better load balancing.
4. **Cloudlet Scheduling Algorithms**: Implement and compare **FCFS (First-Come-First-Serve), Round Robin, and Priority-Based Scheduling**.
5. **Performance Analysis of Cloud Deployment Models** : Simulate and compare **Public, Private, Hybrid, and Community Cloud** environments.
6. **Simulating Denial of Service (DoS) Attacks**: Implement a scenario where multiple requests overload a cloud server.

TEXT BOOKS:

1. Shashank Tiwari, Professional No SQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
2. Pramod Sadalage and Martin Fowler, No SQL Distilled, Addison-Wesley Professional, 2012.

REFERENCE BOOKS:

1. Dan McCreary and Ann Kelly, Making Sense of No SQL, Manning Publications, 2013.
2. Gaurav Vaish, Getting Started with No SQL, Packt Publishing, 2013.