

SEVENTH /  
EIGHTTH  
SEMESTER

<b>Course Code: BTCS 701-18</b>	<b>Course Title : Network Security and Cryptography</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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### **Detailed Contents:**

#### **UNIT 1: Introduction (3 Hours)**

Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model

**[5hrs] (CO 1)**

#### **UNIT 2: Math Background**

Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem

**[5hrs]**

**(CO 1)**

#### **UNIT 3: Cryptography**

Dimensions of Cryptography, Classical Cryptographic Techniques Block Ciphers (DES, AES) : Feistel Cipher Structure, Simplified DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations Public-Key Cryptography : Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography

**[12hrs] (CO 2)**

#### **UNIT 4 Hash and MAC Algorithms**

Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Key Management : Key Distribution Techniques, Kerberos

**[6hrs] (CO 3)**

#### **UNIT 5 Security in Networks**

Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME

**[7hrs] (CO 4)**

### **Course Outcomes:**

After undergoing this course, the students will be able to:

CO1: Understand the fundamental principles of access control models and techniques, authentication and secure system design

CO2: Have a strong understanding of different cryptographic protocols and techniques and be able to use them.

CO3: Apply methods for authentication, access control, intrusion detection and prevention.

CO4: Identify and mitigate software security vulnerabilities in existing systems.

**Suggested Readings/ Books:**

1. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

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<b>Course Code: BTCS -702-18</b>	<b>Course Title: Data Warehousing and Data Mining</b>	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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**Detailed Contents:**

**UNIT 1:**

**Data Warehousing Introduction:** design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP and data cube, Data cube operations, data cube computation.

**Data mining:** What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity

**[10hrs]**

**UNIT 2:**

**Data mining:** Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms

**Classification:** Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method

**[10 hrs]**

**UNIT 3:**

**Cluster analysis:** Introduction, partition methods, hierarchical methods, density based methods, dealing with large databases, cluster software

**Search engines:** Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

**[10 hrs]**

## **UNIT 4:**

**Web data mining:** Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.**[8 hrs]**

### **Suggested Readings / Books:**

1. Carlo Verrellis, Business Intelligence: Data mining and Optimization for Decision Making, WILEY.
2. Han J., Kamber M. and Pei J. , b Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearsoneducation press (1996), 1st ed.
5. Pooniah P. , Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

# **ELECTIVE IV**

Course Code: <b>BTCS 704-18</b>	Course Title : <b>Deep Learning</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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### Detailed Contents:

**UNIT 1: Machine Learning Basics:** Learning, Under-fitting, Overfitting, Estimators, Bias, Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning, Unsupervised Learning and Stochastic Gradient Decent.

**[4hrs] (CO 1)**

**UNIT 2: Deep Feedforward Network:** Feed-forward Networks, Gradient-based Learning, Hidden Units, Architecture Design, Computational Graphs, Back-Propagation, Regularization, Parameter Penalties, Data Augmentation, Multi-task Learning, Bagging, Dropout and Adversarial Training and Optimization.

**[4hrs] (CO 2)**

**UNIT 3: Convolution Networks:** Convolution Operation, Pooling, Basic Convolution Function, Convolution Algorithm, Unsupervised Features and Neuroscientific for convolution Network. **[6hrs] (CO 3)**

**UNIT 4: Sequence Modelling:** Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder- Decoder Sequence-to-Sequence Architectures, Deep Recurrent Network, Recursive Neural Networks and Echo State networks.

**[12hrs] (CO 4)**

**UNIT 5: Deep Generative Models:** Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Sigmoid Belief Networks, Directed Generative Net, Drawing Samples from Auto –encoders.

**[14hrs] (CO 5)**

### Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Comprehend the advancements in learning techniques

CO2: Compare and explain various deep learning architectures and algorithms.

CO3: Demonstrate the applications of Convolution Networks

CO4: Apply Recurrent Network for Sequence Modelling

CO5: Deploy the Deep Generative Models

### Suggested Readings/ Books:

*Text Books:*

1. Goodfellow L., Bengio Y. and Courville A., *Deep Learning*, MIT Press (2016).
2. Patterson J. and Gibson A., *Deep Learning: A Practitioner's Approach*, O'Reilly (2017), 1st ed.

*Reference Books:*

1. Haykin S., *Neural Network and Machine Learning*, Prentice Hall Pearson (2009), 3rd ed.
2. Geron A., *Hands-on Machine Learning with Sci-kit and TensorFlow*, O'Reilly Media (2017)

Course Code: BTCS 705-18	Course Title: Deep Learning Lab	L:0;T:0; 2P:	Credits;1
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**Detailed List of Tasks:**

- Creating a basic network and analyze its performance
- Deploy the Confusion matrix and simulate for Overfitting
- Visualizing a neural network
- Demo: Object Detection with pre-trained RetinaNet with Keras
- Neural Recommender Systems with Explicit Feedback
- Backpropagation in Neural Networks using Numpy
- Neural Recommender Systems with Implicit Feedback and the Triplet Loss
- Fully Convolutional Neural Networks
- ConvNets for Classification and Localization
- Text Classification and Word Vectors
- Character Level Language Model (GPU required)

**Suggested Tools Python/R/MATLAB**

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Course Code: BTCS706-18	Course Title: Distributed Databases	3L: 0T: 0P	Credits: 3
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**Detailed Contents:**

**Unit 1:**

**INTRODUCTION:** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

**DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE:** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

**6 hrs., CO1**

**Unit 2:**

**DISTRIBUTED DATABASE DESIGN:** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation.

**SEMANTICS DATA CONTROL:** View management; Data security; Semantic Integrity Control.

**QUERY PROCESSING ISSUES:** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

**10 hrs., CO1**

**Unit 3:**

**DISTRIBUTED QUERY OPTIMIZATION:** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.

**TRANSACTION MANAGEMENT:** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.

**CONCURRENCY CONTROL:** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management. **10 hrs., CO2**

**Unit 4:**

**RELIABILITY:** Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

**PARALLEL DATABASE SYSTEMS :** Parallel architectures; parallel query processing and optimization; load balancing.

**ADVANCED TOPICS:** Databases, Distributed Object Management, Multi-databases. **10 hrs., CO2,3**

**COURSE OUTCOMES**

After completion of course, students would be able to:

CO1: Design trends in distributed systems.

CO2: Apply network virtualization in distributed environment.

CO3: Apply remote method invocation and objects.

**References:**

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

<b>Course Code:</b> <b>BTCS707-18</b>	<b>Course Title:</b> Distributed Databases lab	<b>L: T: 2P</b>	<b>Credits: 1</b>
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## **Detailed list of Tasks:**

Programs may be implemented using any open source tool

**Expt. 1:** Installation and configuration of database packages.

**Expt. 2:** Creating and managing database objects (Tables, views, indexes etc.)

**Expt. 3:** Creating and managing database security through user management.

**Expt. 4:** Creating and maintaining database links.

**Expt. 5:** Implement Partitioning on the database tables.

**Expt. 6:** Implement various Transaction concurrency control methods [i.e. lock's] by executing multiple update and queries.

**Expt. 7:** Performance tuning of SQL queries.

**Mini Project:** Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

<b>Course Code:</b> <b>BTCS708-18</b>	<b>Course Title:</b> Computer Vision	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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## **Detailed Contents:**

**Unit 1:** Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis. **6 hrs., CO1**

### **Unit 2:**

Edge detection, Edge detection performance, Hough transform, corner detection. **4 hrs., CO1**

### **Unit 3:**

Segmentation, Morphological filtering, Fourier transform. **4 hrs., CO1**

### **Unit 4:**

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing. **8 hrs., CO2**

### **Unit 5:**

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi- supervised. Classifiers: Bayes, KNN, ANN models;

Dimensionality Reduction: PCA, LDA, ICA, and Non- parametric methods.

Recent trends in Activity Recognition, computational photography, Biometrics **8 hrs., CO1**

## **COURSE OUTCOMES**

After completion of course, students would be able to:

**CO1:** Understand image detection and analysis

**CO2:** Identify features to recognize object , scene and categorization from images.

**CO3:** Develop the skills necessary to build computer vision applications.

**References:**

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary of Computer Vision and ImageProcessing, by Fisheretal.

<b>Course Code:</b> <b>BTCS708-18</b>	<b>Course Title:</b> Computer Vision lab	<b>L: T: 2P</b>	<b>Credits: 1</b>
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**Detailed list of Tasks:**

**Programs may be implemented using MATLAB/C/C++/Java/Python on binary/grayscale/color images.**

**Expt. 1:** Implementation of basic image transformations:

- a. Log
- b. Power law
- c. Negation

**Expt. 2:** Implementation the following:

- a. Histogram processing
- b. Histogram equalization/matching

**Expt. 3:** Implementation of piecewise linear transformations

- a. Contrast stretching
- b. Grey level slicing
- c. Bit plane slicing

**Expt. 4:** Implementation of image enhancement/smoothing using

- a. Linear (weighted and non-weighted filters)
- b. Order statistics filters (Nonlinear filters)
  - i. Mean
  - ii. Median
  - iii. Min
  - iv. Max
  - v. Average

**Expt. 5:** Implementation of image enhancement/sharpening using

- a. Laplacian operators
- b. Sobel's operators
- c. Robert's cross operators

**Expt. 6:** Implement the 2D-DFT to obtain Fourier coefficients and reconstruct the image, i.e., IDFT.

**Expt. 7:** Implement image enhancement using Fourier low pass filters

- a. Ideal
- b. Butterworth
- c. Gaussian

**Expt. 8:** Implement image enhancement using Fourier high pass filters

- a. Ideal
- b. Butterworth
- c. Gaussian

**Expt. 9:** Implement algorithms to detect the following in an image

- a. Point
- b. Line
- c. Boundary

**Expt. 10:** Implement Hough transform to detect a line.

**Mini Project:** Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

<b>Course Code: BTCS 710-18</b>	<b>Course Title : Agile Software Development</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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### **Detailed Contents:**

#### **UNIT 1: Introduction**

Need of Agile software development, History of Agile, Agile context– manifesto, principles, methods, values. The benefits of agile in software development.

**[6hrs] (CO 1)**

#### **UNIT 2: Agile Design Methodologies**

Fundamentals, Design principles–Single responsibility, Open-closed, Liskov-substitution, Dependency-inversion, Interface-segregation.

**[6hrs] (CO 2)**

#### **UNIT 3: Scrum**

Introduction to scrum framework, Roles: Product owner, team members and scrum master, Events: Sprint, sprint planning, daily scrum, sprint review, and sprint retrospective, Artifacts: Product backlog, sprint backlog and increments. User stories- characteristics and contents.

**[8hrs] (CO 3)**

#### **UNIT 4: Kanban**

Introduction to Kanban framework, Workflow, Limit the amount of work in progress, pulling work from column to column, Kanban board, Adding policies to the board, Cards and their optimization. **[6hrs] (CO 4)**

## **UNIT 5: Extreme Programming**

Basic values and principles, Roles, Twelve practices of XP, Pair programming, XP team, Life cycle and tools for XP.

**[6hrs] (CO 5)**

## **UNIT 6: Agile Testing**

The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation. **[6hrs] (CO 6)**

### **Course Outcomes:**

After undergoing this course, the students will be able to:

CO1: Understand concept of agile software engineering and its advantages in software development.

CO2 Explain the role of design principles in agile software design.

CO3 Define the core practices behind Scrum framework.

CO4 Understand key principles of agile software development methodology-Kanban.

CO5 Describe implications of functional testing, unit testing, and continuous integration.

CO6 Understand the various tools available to agile teams to test the project.

### **Suggested Readings/ Books:**

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall.
3. Mike Cohn, “User Stories Applied: For Agile Software Development”, Addison Wesley Signature Series.
4. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, Addison Wesley.
5. Paul VII, “Agile: The Complete Overview of Agile Principles and Practices (Agile Product Management)”.
6. Robert Martin, “Agile Software Development, Principles, Patterns, and Practices”, Pearson New International Edition.
7. Greene Jennifer,” Learning Agile”, O’Reilly Series.

<b>Course Code:</b> <b>BTCS 711-18</b>	<b>Course Title : Agile Software Development Lab</b>	<b>L:0T:2P</b>	<b>Credits:1</b>
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### **Detailed List of Tasks:**

1. Understand the background and driving forces for taking an Agile Approach to Software Development.
  2. Build out a backlog and user stories.
  3. To study and use automated build tool.
  4. To study-- version control tool.
  5. To study Continuous Integration tool.
  6. Apply Design principle and Refactoring to achieve agility.
  7. Perform Testing activities within an agile project.
  8. Mini Project: based on tools
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# ELECTIVE V

<b>Course Code:</b> <b>BTCS721-18</b>	<b>Course Title: Block Chain Technology</b>	<b>3L:0 T: 0P</b>	<b>Credits: 3</b>
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## **Detailed Contents:**

### **INTRODUCTION TO BLOCKCHAIN**

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

### **BITCOIN AND CRYPTOCURRENCY**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments- Consensus in a Bitcoin network

### **BITCOIN CONSENSUS**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos

### **DISTRIBUTED CONSENSUS**

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance

### **HYPER LEDGER FABRIC & ETHERUM**

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining, DApps, DAO

### **BLOCKCHAIN APPLICATIONS**

Internet of Things-Medical Record Management System-Block chain in Government and Block chain Security-Block chain Use Cases –Finance

## **COURSE OUTCOMES**

**CO1:** Understand emerging abstract models for Block chain Technology.

**CO2:** Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

**CO3:** It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

**CO4:** Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

### **REFERENCES**

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

<b>Course Code: 713-18</b>	<b>Course Title: Block chain Technology lab</b>	<b>L: T: 2P</b>	<b>Credits:1</b>
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1. To Develop Naive Block chain construction.
2. Design Memory Hard algorithm and its Implementation
3. Design Toy application using Blockchain
5. Program to Solve a Mining puzzles using Block chain
6. The ability to formulate mathematical models and problem-solving skills through programming techniques for addressing real-time problems using appropriate data structures and algorithms.
7. The ability to provide design, build, and deploy a distributed application and provide solutions using block chain applications to enhance business measures by sharing information safely and effectively.
8. The ability to create crypto currencies and give a strong technical understanding of Block chain technologies with an in-depth understanding of applications, open research challenges, and future directions.

<b>Course Code: BTCS714-18</b>	<b>Course Title: Parallel Computing</b>	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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### **Detailed Contents:**

**Introduction:** Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm.

**Hardware taxonomy:** Flynn's classifications, Handler's classifications. Software taxonomy: Kung's taxonomy, SPMD.



**Abstract parallel computational models:** Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism

**Performance Metrics:** Laws governing performance measurements. Metrics - speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks.

**Parallel Processors:** Taxonomy and topology - shared memory mutliprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections. Embeddings and simulations.

**Parallel Programming:** Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

**Scheduling and Parallelization:** Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.

**Books and References:**

1. M. J. Quinn. Parallel Computing: Theory and Practice , McGraw Hill, New York, 1994.
2. T. G. Lewis and H. El-Rewini. Introduction to Parallel Computing , Prentice Hall, New Jersey, 1992.
3. T. G. Lewis. Parallel Programming: A Machine-Independent Approach , IEEE Computer Society Press, Los Alamitos, 1994.

**Research articles.**

<b>Course Code:</b> <b>BTCS715-18</b>	<b>Course Title: Parallel Computing lab</b>	<b>L: T: 2P</b>	<b>Credits: 1</b>
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The details may be designed by course instructor as per the theory.

<b>BTCS 716-18</b>	<b>Adhoc and Wireless Sensor Networks</b>	<b>L:03, T:0, P: 0</b>	<b>Credits: 3</b>
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**Detailed Contents:**

**UNIT 1:**

**{07hrs}(CO1)**

**ADHOC AND SENSORS NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS:**

Wireless Sensor Networks (WSNs): concepts and architectures - Applications of Ad Hoc and Sensor Networks - Design Challenges in Ad hoc and Sensor Networks. Wireless Networks, Issues in Ad hoc wireless networks, Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

**UNIT2:**

**{09hrs}(CO2)**

**WSN NETWORKING CONCEPT AND MAC PROTOCOLS :**

Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks - Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, MAC Protocols for wireless sensors Networks, Low duty cycle Protocols and Wakeup concepts, Classification of MAC Protocols , S-MAC, Contention based protocols -PAMAS schedule based protocols –LEACH, IEEE 802.15.4. MAC protocols , Energy efficient routing challenges and issues in transport layer

### **UNIT 3:**

**{06hrs}(CO3)**

#### **ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS:**

Routing Protocol: Issues in designing a routing protocol for Ad hoc networks - Classification- proactive routing - reactive routing (on-demand) - hybrid routing - Transport Layer protocol for Ad hoc networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks -Classification of Transport Layer solutions-TCP over Ad hoc wireless ,

### **UNIT4:**

**{06hrs}(CO4)**

#### **SENSOR NETWORKS INTRODUCTION AND ARCHITECTURES:**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations.

### **UNIT 5:**

**{07hrs}(CO5)**

#### **SENSOR NETWORK SECURITY- NETWORK SECURITY :**

Security in Ad Hoc Wireless Networks - Network Security Requirements. Network Security requirements issues and Challenges in security provisioning Network, Security Attacks. Layer wise attack in wireless sensor networks, possible solutions for Jamming, tampering black hole attack, Flooding attack, Key distribution and Management, Secure Routing -SPINS reliability requirements in sensors Networks. Sensor Network Platforms and Tools

### **Course Outcomes:**

After undergoing this course, the students will be able to:

<b>CO Nos.</b>	<b>Course Outcomes:</b>
<b>CO1</b>	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks and apply this knowledge to identify the suitable routing algorithm based on the network.
<b>CO2</b>	Apply the knowledge to identify appropriate physical and MAC layer protocols
<b>CO3:</b>	Understand the transport layer and Describe routing protocols for ad hoc wireless networks with respect to TCP design issues
<b>CO 4</b>	Be familiar with the OS used in Wireless Sensor Networks and build basic modules
	CO 5:

<b>CO 5</b>	Understand the Challenges in security provisioning ,Security Attacks and security issues possible in Adhoc and Sensors Networks
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#### **Suggested Readings/ Books:**

##### **Text Books:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Pearson Education, 2008.
2. Labiod. H, "Wireless Adhoc and Sensor Networks", Wiley, 2008.
3. 3. Li, X, "Wireless ad -hoc and sensor Networks: theory and applications", Cambridge University Press, 2008.

##### **Reference Books**

1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", world Scientific Publishing Company, 2nd edition, 2011.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005 (soft copy available) .
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007. (soft copyavailable).
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.(soft copy available)

##### **Online Resources:**

1. [www.wirelessnetworksonline.com](http://www.wirelessnetworksonline.com)
2. [www.securityinwireless.com](http://www.securityinwireless.com)
3. [www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf](http://www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf) Practice Aspects 1. NS2 Simulator tool

<b>BTCS 717-18</b>	<b>Adhoc and Wireless Sensor Networks Lab</b>	<b>L:0, T:0, P: 2</b>	<b>Credits: 1</b>
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#### List of Experiments :

Sr. No	Name and list of Practical
1	Introduction of Wireless sensor network applications and its simulation
2	Network Simulator installation of wireless sensor network.
3	Implementation of routing protocol in NS2 for DSR protocol
4	Study other wireless sensor network simulators (Mannasim. Contiki
5	Implementation of routing protocol in NS2 for AODV protocol for TORA protocol

<b>Course Code:</b> <b>BTCS718-18</b>	<b>Course Title:</b> Quantum Computing	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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## Detailed Syllabus

**UNIT-1** Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. 8

Hrs.

**UNIT-II** Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.

8 Hrs.

**UNIT-III** Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance. 8

Hrs.

**UNIT-IV** Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. 8

Hrs.

**UNIT-V** Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource . 8

Hrs.

### Course Outcomes;

#### At the end of the course students should:

- CO1: understand the quantum model of computation and the basic principles of quantum mechanics;
- CO2: be familiar with basic quantum algorithms and their analysis;
- CO3: be familiar with basic quantum protocols such as teleportation and super dense coding;
- CO4: see how the quantum model relates to classical models of deterministic and probabilistic computation.

### Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , “Quantum Computing - A Gentle Introduction” (Scientific and Engineering Computation) Paperback – Import, 3 Oct 2014
3. Computing since Democritus by Scott Aaronson

4. Computer Science: An Introduction by N. David Mermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

<b>Course Code:</b> <b>BTCS719-18</b>	<b>Course Title:</b> Quantum Computing lab	<b>L: T: 2P</b>	<b>Credits: 1</b>
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1. List modern relevant quantum algorithms and their purposes.
2. Explain the key principles of the various models of quantum computation (circuit, measurement-based, adiabatic model).
3. Explain the basic structure of the quantum algorithms addressed in the course that are based on the circuit model, and to compute the outcome of basic quantum circuits.
4. Compare, in terms of time complexity, what quantum advantage is expected from the quantum algorithms addressed in the course with respect to their classical counterparts.
5. Program simple quantum algorithms on a cloud quantum computer or a cloud simulator.
6. Understand the basic principles of the continuous variable encoding for quantum information processing.
7. Give examples of the motivation for applying quantum computing to machine learning and of what the obstacles are to achieving an advantage from doing so.