# *Fifth Semester*

## BTCS 501 Computer Networks –II

***Objectives: The objective of the course is to offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.***

**Course Contents:**

1. **Network Security**: Fundamentals of network security, Basics of IPv6, IPsec: overview of IPsec, IP and IPv6, Authentication header (AH), Encapsulating Security Payload (ESP). [6]
2. **Internet Key Exchange (IKE):** History, Photuris, Simple Key-management for Internet protocols (SKIP), IKE phases, IKE encoding. [6]
3. **Adhoc networks**: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. [6]
4. **Wireless Communication Systems**: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. [6]
5. **3G wireless networks**: wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks. [6]
6. **Wireless System Design:** Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems. [6]

**Suggested Readings/Books**:

1. Theodore S. Rappaport, Wireless Communication: Principles and Practices (2nd Edition), Pearson Education.
2. Charlie Kaufman, Radio Perlman, Mike Speciner, Neywork security, 2nd ed., PHI.
3. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, Wireless and mobile networks: concepts and protocols, Wiley India.
4. Michael A. Gallo & William M. Hancock, "Computer Communications and Networking Technologies", Cengage Learning / Thomson Brooks / Cole
5. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education.
6. Mayank Dave, "Computer Networks", Cengage Learning

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## BTCS 502 Relational Database Management System-I

**Objectives:** This course offers a good understanding of database systems concepts and prepares the student to be in a position to use and design databases for different applications.

**Introduction to Database Systems:**

File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence. [6]

**Physical Data Organization:**

File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable Length Records.[6]

**Data Models:**

Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.[5]

**The Relational Model:**

Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data.[5]

**Relational Query Languages:**

SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL, Triggers and Active Database, Relational Completeness, Basic Query Optimization Strategies, Algebraic Manipulation and Equivalences.[7]

**Database Design:**

Functional Dependencies, Reasoning about Functional Dependencies, Normal Forms, Schema Refinement, First, Second and Third Normal Forms, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions.[5]

**Transaction Management:**

ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem , Read-Write Locks, Deadlocks Handling, 2PL protocol.[6]

**Database Protection:**

Threats, Access Control Mechanisms, Discretionary Access Control, Grant and Revoke, Mandatory Access Control, Bell LaPadula Model, Role Based Security, Firewalls, Encryption and Digital Signatures.[5]

**Suggested Readings/Books**:

1. Ramez Elmasri, Shamkant Navathe ,Fundamentals of Database Systems, Fifth Edition, Pearson Education, 2007.
2. C.J. Date , An Introduction to Database Systems, Eighth Edition, Pearson Education
3. Alexis Leon, Mathews Leon , Database Management Systems, Leon Press.
4. S. K. Singh, Database Systems Concepts, Design and Applications, Pearson Education.

5. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Tata McGraw-Hill.
6. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Tata McGraw-Hill.

## BTCS 503 Design & Analysis of Algorithms

**Objective**: To learn the ability to distinguish between the tractability and intractability of a given computational problem. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

**Prerequisites**: Data Structures

**Introduction**. What is an algorithm ? Time and space complexity of an algorithm. Comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time.

**Basic Algorithm Design Techniques.** Divide-and-conquer, greedy, randomization, and dynamic programming. Example problems and algorithms illustrating the use of these techniques.

**Graph Algorithms**. Graph traversal: breadth-first search (BFS) and depth-first search (DFS). Applications of BFS and DFS. Topological sort. Shortest paths in graphs: Dijkstra and Bellman-Ford. Minimum spanning trees.

**Sorting and searching**. Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting. Median and order statistics.

**NP-completeness**. Definition of class NP. NP-hard and NP-complete problems. 3SAT is NP-complete. Proving a problem to be NP-complete using polynomial-time reductions. Examples of NP-complete problems.

**Coping with NP-completeness.** Approximation algorithms for various NP-complete problems.

**Advanced topics**. Pattern matching algorithms : Knuth-Morris-Pratt algorithm. Algorithms in Computational Geometry : Convex hulls. Fast Fourier Transform (FFT) and its applications. Integer and polynomial arithmetic. Matrix multiplication : Strassen's algorithm.

**Suggested Readings/Books**:

1. Algorithm Design by J. Kleinberg and E. Tardos.
2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
3. Algorithms by S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani.
4. Algorithm Design: Foundations, Analysis, and Internet Examples by Michael T. Goodrich and Roberto Tamassia.
5. The Design and Analysis of Computer Algorithms by A. V. Aho, J. E. Hopcroft, and J. D. Ullman.
6. The Art of Computer Programming, Volumes 1, 2, and 3, by Donald Knuth.

## BTCS 504 Computer Graphics

**OBJECTIVES:**

Understanding the fundamental graphical operations and the implementation on computer, Get a glimpse of recent advances in computer graphics, Understanding user interface issues that make the computer easy for the novice to use.

**COURSE CONTENTS:**

1. **Introduction**: Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices.
2. **Basic Raster Graphics**: Scan conversion- Point plot technique, Line drawing, Circle generating and Ellipse generating algorithms.
3. **Two-dimensional Geometric Transformations** : Basic Transformations-Translation, Rotation and Scalling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.
4. **Clipping:** Window to viewport transformation, Clipping Operations- Point Clipping, Line Clipping, Polygon Clipping and Text Clipping.
5. **Filling Techniques**: Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm, Edge fill and fence fill algorithms,
6. **Elementary 3D Graphics**: Plane projections and its types, Vanishing points, Specification of a 3D view.
7. **Visibility**: Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.
8. **Advance Topics**: Introduction of Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

**Suggested Readings/Books**:

**1.** Donald Hearn and M.Pauline Baker, **"Computer Graphics", Second Edition,** PHI/Pearson Education.

**2.** Zhigand xiang, Roy Plastock, Schaum's outlines, **"Computer Graphics Second Edition",** Tata Mc-Grawhill edition.

**3.** C, Foley, VanDam, Feiner and Hughes, **"Computer Graphics Principles & Practice"**, **Second Edition**, Pearson Education

## BTCS 505 Computer Peripherals and Interfaces

**OBJECTIVES:** To learn the functional and operational details of various peripheral devices.

1. **SYSTEM RESOURCES**: Interrupt, DMA Channel, I/O Port Addresses and resolving and resolving the conflict of resources. I/O buses- ISA, EISA, Local bus, VESA Local bus, PCI bus, PCI Express, Accelerated graphics port bus.

2. **IDE & SCSI Interfaces**: IDE origin, IDE Interface ATA standards ATA1 to ATA7. ATA feature, ATA RAID and SCSI RAID, SCSI Cable and pin Connector pin outs SCSI V/s IDE Advantages and limitation.

3. **Video Hardware** : Video display technologies, DVI Digital signals for CRT Monitor,LCD Panels, Video adapter types, Integrated Video/ Motherboard chipset, Video RAM,Video driver and multiple Monitor, Graphic accelerators. Advanced 3D Technologies,TV Tuner and Video Capture upgrades troubleshooting Video Cards and Drivers.

4. **I/O Interfaces:** I/O Interfaces from USB and IEEE1394, I/O Interface from serial and Parallel to IEEE1394 and USB 961, Parallel to SCSI converter. Testing of serial andparallel port, USB Mouse/ Keyboard Interfaces.

5. **Input/ Output Driver software aspects:** Role of device driver DOS and UNIX/ LINUX device drivers.

6. Design & Integration of Peripheral devices to a computer system as a Case Study

7. **Future Trends:** Detailed Analysis of recent Progress in the Peripheral and Bus systems. Some aspects of cost Performance analysis while designing the system

**Suggested /Readings / Books**

**1.** Douglas V. Hall ,**"Microprocessors and Interfacing",** Tata McGraw Hill 2006.
**2.** Barry B. Brey & C.R.Sarma**" The intel microprocessors,"** Pearson 2003.
**3.** P. Pal Chandhari , **"Computer Organization and design"** Prentice Hall of India Pvt. Ltd, 1994.
**4.** Del Corso, H.Kirrman, JD Nicond **"Microcomputer buses & links"** Academic Press 1986.

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## BTCS 506 RDBMS LAB

*Note:* This practical will enable students to retrieve data from relational databases using SQL. Students will also learn about triggers, cursors, stored procedures etc.

1. Introduction to SQL and installation of SQL Server / Oracle.

2. Data Types, Creating Tables, Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statements.

3. Working with Null Values, Matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statements.

4. Set Operators, Nested Queries, Joins, Sequences.

5. Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.
6. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters.
7. Stored Procedures and Exception Handling.
8. Triggers and Cursor Management in PL/SQL.

**Suggested Tools –** MySQL, DB2, Oracle, SQL Server 2012, Postgre SQL, SQL lite

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## BTCS 507 Computer Networks – II LAB

1. To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the same computer.
2. To plan IPv6 address scheme for a local area network comprising of 'n' terminals.
3. To develop programs for implementing / simulating routing algorithms for Adhoc networks.
4. To install any one open source packet capture software like wireshark etc.
5. To configure Wireless Local Loop.
6. To plan Personal Area Network.
7. To configure WLAN.
8. To configure Adhoc networks.
9. To install and configure wireless access points.

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## BTCS 508 Design & Analysis of Algorithms Lab

**Objective:** To get a first-hand experience of implementing well-known algorithms in a high-level language. To be able to compare the practical performance of different algorithms for the same problem.

1. Code and analyze to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyze to find the median element in an array of integers.
3. Code and analyze to find the majority element in an array of integers.
4. Code and analyze to sort an array of integers using Heap sort.
5. Code and analyze to sort an array of integers using Merge sort.
6. Code and analyze to sort an array of integers using Quick sort.
7. Code and analyze to find the edit distance between two character strings using dynamic programming.

8. Code and analyze to find an optimal solution to weighted interval scheduling using dynamic programming.
9. Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.
10. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as (i) to find the topological sort of a directed acyclic graph, OR (ii) to find a path from source to goal in a maze.
11. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as (i) to find connected components of an undirected graph, OR (ii) to check whether a given graph is bipartite.
12. Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.
13. Code and analyze to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm.
14. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
15. Code and analyze to find all occurrences of a pattern P in a given string S.
16. Code and analyze to multiply two large integers using Karatsuba algorithm.
17. Code and analyze to compute the convex hull of a set of points in the plane.
18. (Mini-project Topic) Program to multiply two polynomials using Fast Fourier Transform (FFT).

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**BTCS 509 Computer Graphics Lab**

1. To plot a point (pixel) on the screen.
2. To draw a straight line using DDA Algorithm.
3. To draw a straight line using Bresenham's Algorithm.
4. Implementation of mid-point circle generating Algorithm.
5. Implementation of ellipse generating Algorithm.
6. To translate an object with translation parameters in X and Y directions.
7. To scale an object with scaling factors along X and Y directions.
8. To rotate an object with a certain angle about origin.
9. Perform the rotation of an object with certain angle about an arbitrary point.
10. To perform composite transformations of an object.
11. To perform the reflection of an object about major axis.

12. To clip line segments against windows using Cohen Sutherland Algorithm.
13. Perform the polygon clipping against windows using Sutherland Hodgeman technique.
14. Fill a rectangle with a specified color using scan line algorithm.
15. Implementation of flood-fill and boundary-fill algorithms.

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**BTCS 510 Industrial Training**

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