

**UNIVERSITY OF LUCKNOW**  
**FACULTY OF ENGINEERING & TECHNOLOGY**

**Evaluation Scheme for B. Tech.**

**Branch : Computer Science & Engineering**

**SEMESTER - V**

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
<b>Theory</b>									
01.	CS - 501	Concepts of Operating System	3--1--0	20	10	30	70	100	4
02.	CS - 502	Database Management Concepts	3--1--0	20	10	30	70	100	4
03.	CS - 503	Software Engineering	3--0--0	20	10	30	70	100	3
04.	CS - 504	Web Technology	3--0--0	20	10	30	70	100	3
05.	CS - 505	Compiler Design	3--1--0	20	10	30	70	100	4
<b>Practical</b>									
06.	CS - 551	Operating System Lab	0--0--3	-	40	40	60	100	2
07.	CS - 552	Database Management System Lab	0--0--3	-	40	40	60	100	2
08.	CS - 553	Software Engineering Lab	0--0--2	-	20	20	30	50	1
09.	CS - 554	Web Technology Lab	0--0--2	-	20	20	30	50	1
10.	GP - 501	General Proficiency				50		50	
<b>Total</b>			<b>15-3-10</b>					<b>800</b>	<b>24</b>

**Abbreviations :** CT - Class Test  
ESE - End Semester Examination

TA - Teacher's Assessment

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**SEMESTER - VI**

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
<b>Theory</b>									
01.	CS - 601	Design and Analysis of Algorithm	3--1--0	20	10	30	70	100	4
02.	CS - 602	Computer Network	3--1--0	20	10	30	70	100	4
03.	CS - 603	Computer Architecture	3--1--0	20	10	30	70	100	4
04.	CS - 604	Graph Theory	3--0--0	20	10	30	70	100	3
05.	CS - 605	Any one from the list (DE – 1)	3--0--0	20	10	30	70	100	3
<b>Practical</b>									
06.	CS - 651	Design and Analysis of Algorithm Lab	0--0--2	-	20	20	30	50	1
07.	CS - 652	Computer Network Lab	0--0--2	-	20	20	30	50	1
08.	CS - 653	Mini Project	0--0--3	-	40	40	60	100	2
09.	CS - 654	Seminar	0--0--3	-	40	40	60	100	2
10.	GP - 601	General Proficiency				50		50	
<b>Total</b>			<b>15-3-10</b>					<b>800</b>	<b>24</b>

**Abbreviations :** CT - Class Test

ESE - End Semester Examination

TA - Teacher's Assessment

DE - Department Elective

**Note :** Students have to undergo Industrial Training for a period of six weeks during summer vacation. The report of Industrial Training will be submitted to the Head of the Department in the beginning of seventh semester.

**Departmental Elective – 1 :-**

CS - 6051	Software Project Management
CS - 6052	Multimedia System
CS - 6053	Software Testing & Audit
CS - 6054	E-Commerce
CS- 6055	Web Mining
CS- 6055	Data Compression

# CS - 501 OPERATING SYSTEM

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>1</b>	<b>0</b>

## **Unit-I** **08**

**Introduction:** Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, operating system structure- layered structure, system components, and operating system services.

## **Unit-II** **06**

**Process and CPU Scheduling:** Process concept, process states, process state transition diagram, scheduling concepts, performance criteria, schedulers, process control block (PCB), threads and their management, scheduling algorithms, and multiprocessor scheduling.

## **Unit-III** **10**

**Concurrent Processes and Deadlock:** Principle of concurrency, producer / consumer problem, mutual exclusion, critical section problem, semaphores, test and set operation; Classical problem in concurrency- dining philosopher problem, sleeping barber problem; Inter process communication models and schemes, and process generation. **Deadlock:** System model, deadlock characterization, prevention, avoidance, detection, and recovery from deadlock.

## **Unit -IV** **08**

**Memory Management:** Basic bare machine, resident monitor, multiprogramming with fixed partitions, multiprogramming with variable partitions, paging, segmentation, paged segmentation, virtual memory concepts, demand paging, performance of demand paging, page replacement algorithms, thrashing, and cache memory organization.

## **Unit -V** **08**

**I/O Management and Disk Scheduling:** I/O devices, and I/O subsystems, I/O buffering, disk storage and disk scheduling, RAID. **File System:** File concept, file organization and access mechanism, file directories, file system implementation issues, and file system protection & security.

### **Text Book:**

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley

### **Reference Books:**

1. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
2. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
3. D M Dhamdhare, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.
4. William Stallings, "Operating Systems: Internals and Design Principles ", 6th Edition, Pearson Education

**CS - 502**  
**DATABASE MANAGEMENT CONCEPTS**

**L T P**  
**3 1 0**

**Unit-I** **08**

**Introduction:** An overview of database management system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure.

**Data Modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

**Unit-II** **08**

**Relational data Model and Language:** Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus.

**Introduction to SQL Statements:** Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions, joins, unions, intersection, minus, cursors, and triggers.

**Unit-III** **08**

**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs.

**Unit-IV** **08**

**Transaction Processing Concept:** Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

**Unit-V** **08**

**Concurrency Control Techniques:** Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

**Text Book:**

1. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill.

**Reference Books:**

1. Date C J, "An Introduction to Database Systems", Addison Wesley.
2. Elmasri, Navathe, "Fundamentals of Database Systems", Addison Wesley.
3. O'Neil, Databases, Elsevier Pub.
4. Leon & Leon, "Database Management Systems", Vikas Publishing House.
5. Bipin C. Desai, "An Introduction to Database Systems", Gargotia Publications.
6. Majumdar & Bhattacharya, "Database Management System", TMH.
7. Ramkrishnan, Gehrke, "Database Management System", McGraw Hill.

**CS - 503**  
**SOFTWARE ENGINEERING**

**L T P**  
**3 0 0**

**Unit-I** **08**

**Introduction:** Software components, software characteristics, software crisis, software engineering processes, similarity and differences from conventional engineering processes, and software quality attributes.

**SDLC Models:** Water fall model, prototype model, spiral model, evolutionary development models, iterative enhancement models, and agile software development model.

**Unit-II** **08**

**Software Requirement Specifications:** Requirement engineering process, elicitation, analysis, documentation, review and management of user needs, feasibility study, information modeling, data flow diagrams, entity relationship diagrams, decision tables, SRS document, and IEEE standards for SRS. **SQA:** Verification and validation, SQA plans, software quality frameworks, ISO 9000 models, and SEI-CMM model

**Unit-III** **08**

**Software Design:** Basic concept, architectural design, low level design: modularization, design structure charts, pseudo codes, flow charts, coupling and cohesion measures, design strategies: function oriented design, object oriented design, top-down and bottom-up design.

**Software Measurement and Metrics:** Halstead's software science, function point (FP) based measures, and cyclomatic complexity measures: Control flow graphs.

**Unit-IV** **08**

**Software Testing:** Testing objectives, unit testing, integration testing, acceptance and regression test, testing for functionality and performance, **Top-down and bottom-up testing strategies:** test drivers and test stubs, structural testing (white box testing), functional testing (black box testing), test data suit preparation, alpha and beta testing of products, **Static testing strategies:** Formal technical reviews, walk through, code inspection, and compliance with design & coding standards.

**Unit-V** **08**

**Software Maintenance and Software Project Management:** Software as an evolutionary entity, need for maintenance, categories of maintenance, cost of maintenance, software re-engineering, reverse engineering, software configuration management activities, change control process, software version control, an overview of CASE tools, estimation of various parameters such as cost, efforts, schedule/duration, and constructive cost models (COCOMO).

**Text Book:**

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

**Reference Books:**

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. Pankaj Jalote, Software Engineering, Wiley
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.

**CS - 504**  
**WEB TECHNOLOGY**

**L T P**  
**3 0 0**

<b>Unit-I</b> <b>Introduction:</b> Introduction to web, protocols governing the web, web development strategies, web applications, web project, and web team.	<b>08</b>
<b>Unit-II</b> <b>HTML:</b> List, table, images, frames, forms, and CSS.	<b>08</b>
<b>Unit-III</b> <b>XML:</b> TAGS, DTD, XML schemes, presenting and using XML.	<b>08</b>
<b>Unit -IV</b> <b>Java script :</b> Introduction, documents, forms, statements, functions, objects, event and event handling, introduction to AJAX, VB Script, and CGI	<b>08</b>
<b>Unit-V</b> <b>Server Site Programming:</b> Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables and methods, debugging, and sharing data between JSP pages.	<b>08</b>

**Text Books:**

1. Xavier, C, “ Web Technology and Design” , New Age International.
2. Ivan Bayross,” HTML, DHTML, Java Script, Perl & CGI”, BPB Publication.

**Reference Books:**

1. Deitel, “Java for programmers”, Pearson Education.
2. Ramesh Bangia, “Internet and Web Design”, New Age International.
3. Jackson, “Web Technologies” Pearson Education.
4. Patel and Barik, ”Introduction to Web Technology & Internet”, Acme Learning.

# CS - 505

## COMPILER DESIGN

L	T	P
3	1	0

### Unit-I 08

**Introduction:** Introduction to compiler, phases and passes, bootstrapping, finite state machines and regular expressions and their applications to lexical analysis, optimization of DFA-based pattern matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, formal grammars and their application to syntax analysis, ambiguity, and YACC.

**The syntactic specification of programming languages:** Context free grammars, derivation & parse trees, and capabilities of CFG.

### Unit-II 08

**Basic Parsing Techniques:** Parsers, shift reduce parsing, operator precedence parsing, and top down parsing.

**Predictive parsers Automatic Construction of efficient Parsers:** LR parsers, the canonical collection of LR(0) items, constructing SLR parsing tables, constructing canonical LR parsing tables, constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.

### Unit-III 08

**Syntax-directed Translation:** Syntax-directed translation schemes, implementation of syntax directed translators, intermediate code, postfix notation, parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, boolean expressions, statements that alter the flow of control, postfix translation, and translation with a top down parser.

### Unit-IV 08

**Symbol Tables:** Data structure for symbols tables, and representing scope information.

**Run-Time Administration:** Implementation of simple stack allocation scheme, and storage allocation in block structured language.

**Error Detection & Recovery:** Lexical Phase errors, and syntactic phase errors semantic errors.

### Unit -V 08

**Code Generation:** Design issues, the target language, addresses in the target code, basic blocks and flow graphs, optimization of basic blocks, and code generator.

**Code Optimization:** Machine-independent optimizations, loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, and global data-flow analysis

#### Text Book:

1. Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

#### Reference Books:

1. V Raghvan, " Principles of Compiler Design", TMH
2. Kenneth Loudon," Compiler Construction", Cengage Learning.
3. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

**CS - 551**  
**OPERATING SYSTEM LAB**

**L    T    P**  
**0    0    3**

**LIST OF PRACTICALS**

1. Write a C program to implement FCFS CPU Scheduling Algorithms.
2. Write a C program to implement SJF CPU Scheduling Algorithms.
3. Write a C program to implement SRTF CPU Scheduling Algorithms.
4. Write a C program to implement PRIORITY CPU Scheduling Algorithms.
5. Write a C program to implement ROUND ROBIN Scheduling Algorithms.
6. Write a C program to implement BANKER'S Algorithms.
7. Write a C program to implement FIFO Page Replacement Algorithm.
8. Write a C program to implement LRU Page Replacement Algorithm.
9. Write a C program to implement OPTIMAL Page Replacement Algorithm.
10. Simulate Paging Technique of Memory Management

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.



**CS - 552**  
**DATABASE MANAGEMENT SYSTEM LAB**

**L T P**  
**0 0 3**

**LIST OF PRACTICALS**

**Part I:** Getting familiar with SQL (Maximum number of turns allotted: 3)

- 1) Creating tables.
- 2) Insertion, Deletion, Updation and Retrieval of data.
- 3) Arithmetic operations, Logical operations and Pattern matching.
- 4) Concept of Grouping (Group by clause, Having Clause).
- 5) Use Aggregate function in query.
- 6) Write commands for Joins, Union and Intersection.
- 7) Concept of Sub-query.
- 8) Concept of Data constraints (Unique Key, Primary Key, Foreign Key).
- 9) Creating Views and Indexes.
- 10) Creating Trigger.

**Part II:** Relational Database Implementation

Implement the following mini-project's database schemas and give an expression in SQL for each of the queries.

**Project 1. Library Management System:**

Create the following schema. Enter at least 5 records, in accordance with the query asked, in each table and answer the queries given below.

**Library Books** (Accession number, Title, Author, Department, Purchase Date, Price)

**Issued Books** (Accession number, Borrower)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Delete the record of book titled "Database System Concepts".
- c) Change the Department of the book titled "Discrete Mathematics" to "CSE".
- d) List all books that belong to "CSE" department.
- e) List all books that belong to "CSE" department and are written by author "Navathe".
- f) List all computer (Department="CSE") that have been issued.
- g) List all books which have a price less than 500 or purchased between "01/01/2015" and "01/01/2019".

**Project 2. Student Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Student** (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)

Paper Details (Paper code, Name of the Paper)

**Academic – details** (College roll number, Paper code, Attendance, Marks in home examination)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.
- c) List all students who live in “Lucknow” and have marks greater than 60 in paper 1.
- d) Find the total attendance and total marks obtained by each student.
- e) List the name of student who has got the highest marks in paper 2.

### **Project 3. Customer Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Customer** (Cust ID, email, Name, Phone, Referrer ID)

**Bicycle** (Bicycle ID, Date Purchased, Color, Cust ID, Model No.)

**Bicycle Model** (Model No., Manufacturer, Style)

**Service** (Start Date, Bicycle ID, End Date)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) List all the customers who have the bicycles manufactured by manufacturer “Honda”.
- c) List the bicycles purchased by the customers who have been referred by customer “C1”.
- d) List the manufacturer of red colored bicycles.
- e) List the models of the bicycles given for service.

### **Project 4. Human Resource Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**EMPLOYEE**( Person-Name, Street, City )

**WORKS**( Person-Name, Company-Name, Salary )

**COMPANY** ( Company-Name, City )

**MANAGES** ( Person-Name, Manager-Name )

- a) Identify primary and foreign keys.
- b) Alter table employee, add a column “email” of type varchar (20).
- c) Find the name of all managers who work for both Samba Bank and NCB Bank.
- d) Find the names, street address and cities of residence and salary of all employees who work for “Samba Bank” and earn more than \$10,000.
- e) Find the names of all employees who live in the same city as the company for which they work.
- f) Find the highest salary, lowest salary and average salary paid by each company.
- g) Find the sum of salary and number of employees in each company.
- h) Find the name of the company that pays highest salary.

**Project 5. Supplier Management System:**

Create the following schema. Enter at least 5 records, in accordance with the queries asked, in each table and answer the queries given below.

**Suppliers** (S No, Sname, Status, S City)

**Parts** (P No, Pname, Colour, Weight, City)

**Project** (J No, J name, J city)

**Shipment** (Sno, Pno, Jno, Qunantity)

- a) Identify primary and foreign keys.
- b) Get supplier numbers for suppliers in Paris with status>20.
- c) Get suppliers names for suppliers who do not supply part P2.
- d) For each shipment get full shipment details, including total shipment weights.
- e) Get all the shipments where the quantity is in the range 300 to 750 inclusive.
- f) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
- g) Get the names of cities that store more than five red parts.
- h) Get full details of parts supplied by a supplier in Delhi.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**CS - 553**  
**SOFTWARE ENGINEERING LAB**

**L T P**  
**0 0 2**

**LIST OF PRACTICALS**

**Note: - At least 6 mini-projects are to be implemented from Part II.**

**Part I** – To Familiarize with CASE tools using ATM system as specification. (Maximum number of turns allotted: 3)

1. Introduction and project definition
2. Software process overview
3. Project planning
4. Software requirements
5. Introduction to UML and use case diagrams
6. System modeling (DFD and ER)
7. Flow of events and activity diagram
8. OO analysis: discovering classes
9. Interaction diagrams: sequence and collaboration diagrams
10. Software Design: software architecture and object-oriented design
11. State Transition Diagram
12. Component and deployment diagrams
13. Software testing
14. Presentations.

**Part II-** Design a mini-project using CASE tools

Students are divided into batches of 5 each and each batch has to draw the following diagrams using UML for given different case studies for each batch. UML diagrams to be developed are:

1. Use Case Diagram.
2. Class Diagram.
3. Sequence Diagram.
4. Collaboration Diagram.
5. State Diagram

6. Activity Diagram.
7. Component Diagram
8. Deployment Diagram.

**Projects:**

1. Patient Appointment and Prescription Management System
2. Organized Retail Shopping Management Software
3. Online Hotel Reservation Service System
4. Examination and Result computation system
5. Automatic Internal Assessment System
6. Parking Allocation System
7. Wholesale Management System
8. Criminal Record Management : Implement a criminal record management system for jailers, police officers and CBI officers
9. DTC Route Information: Online information about the bus routes and their frequency and fares
10. Car Pooling: To maintain a web based intranet application that enables the corporate employees within an organization to avail the facility of carpooling effectively.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**CS - 554**  
**WEB TECHNOLOGY LAB**

**L   T   P**  
**0   0   2**

**LIST OF PRACTICALS**

1. HTML program to create resume preparation using tables.
2. HTML program for home page creation using frames.
3. HTML program for form creation.
4. Create a web page to embed an image map in a web page using HTML.
5. Create a web page to fix the hot spots and to show all the related information when the hot spots are clicked using HTML.
6. Create a web page to get the coordinates from an image using java script.
7. Create a web page with all types of cascading style sheets.
8. Write HTML/Java scripts to display your CV in navigator, your institute website, Department website and tutorial website for specific subject.
9. Design HTML form for keeping student record and validate it using Java script.
10. Writing program in XML for creation of DTD, which specifies set of rules.
11. Create a style sheet in CSS/ XSL & display the document in internet explorer.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**CS - 601**  
**DESIGN AND ANALYSIS OF ALGORITHMS**

**L    T    P**  
**3    1    0**

**Unit-I** **08**

**Introduction:** Algorithms, analyzing algorithms, complexity of algorithms, growth of functions, performance measurements, sorting and order statistics - shell sort, quick sort, merge sort, heap sort, comparison of sorting algorithms, and sorting in linear time.

**Unit -II** **08**

**Advanced Data Structures:** Red-Black trees, B – trees, binomial heaps, and fibonacci heaps.

**Unit - III** **08**

**Design and Analysis Technique:** Divide and conquer with examples such as sorting, matrix multiplication, convex hull and searching, greedy methods with examples such as optimal reliability allocation, Knapsack, minimum spanning trees – Prim’s and Kruskal’s algorithms, single source shortest paths – Dijkstra’s and Bellman ford algorithms.

**Unit - IV** **08**

**Dynamic Programming:** Knapsack, all pair shortest paths – Floyd-Warshall algorithms, backtracking, branch and bound with examples such as travelling salesman problem, graph coloring, n-Queen problem, and Sum of subsets problems.

**Unit -V** **08**

**Selected Topics:** String Matching, theory of NP-completeness, approximation algorithms, and randomized algorithms.

**Text Book:**

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.

**Reference Books:**

1. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, McGraw Hill, 2005.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Berman, Paul," Algorithms", Cengage Learning.
4. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.

# CS - 602 COMPUTER NETWORK

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>1</b>	<b>0</b>

## Unit –I

**08**

**Introduction Concepts:** Goals and applications of networks, network structure and architecture, the OSI reference model, services, **Network Topology Design:** Delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

## Unit-II

**08**

**Medium Access sub layer:** Medium access sub layer - channel allocations, LAN protocols - ALOHA protocols - overview of IEEE standards - FDDI. Data Link Layer - Elementary data link protocols, sliding window protocols, and error handling.

## Unit - III

**08**

**Network Layer:** Point to point networks, routing, and congestion control.  
**Internet Working** -TCP / IP, IP packet, IP address, IPv6.

## Unit - IV

**08**

**Transport Layer:** Transport layer design issues, connection management, session layer design issues, and remote procedure call. Presentation layer design issues, data compression techniques, cryptography - TCP - window management.

## Unit-V

**08**

**Application Layer:** File transfer, access and management, electronic mail, virtual terminals, other application. Example networks - Internet and public networks.

## Text Book:

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education

## Reference Books:

1. W. Stallings, Data and Computer Communication, Macmillan Press
2. Anuranjan Misra, "Computer Networks", Acme Learning
3. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media



# CS - 603

## COMPUTER ARCHITECTURE

L	T	P
3	1	0

### Unit-I 08

**Introduction:** Parallel computing, parallel computer model, program and network properties, parallel architectural classification schemes, Flynn's & Feng's classification, performance metrics and measures, **Speedup Performance Laws:** Multiprocessor system and interconnection networks; **IEEE POSIX Threads:** Creating and exiting threads, simultaneous execution of threads, and thread synchronization using semaphore and mutex.

### Unit-II 08

**Pipelining and Memory Hierarchy:** Basic and intermediate concepts, Instruction set principle; **ILP:** Basics, exploiting ILP, limits on ILP; linear and nonlinear pipeline processors; super scalar and super pipeline design; **Memory Hierarchy Design:** Advanced optimization of cache performance, memory technology and optimization, cache coherence, and synchronization mechanisms.

### Unit-III 08

**Thread and Process Level Parallel Architecture:** Introduction to MIMD architecture, multithreaded architectures, distributed memory MIMD architectures, shared memory MIMD architecture, clustering, instruction level data parallel architecture, SIMD architecture, fine grained and coarse grained SIMD architecture, associative and neural architecture, data parallel pipelined and systolic architectures, vector architectures.

### Unit-IV 08

**Parallel Algorithms:** PRAM Algorithms: Parallel reduction, prefix sums, preorder tree traversal, merging two sorted lists; matrix multiplication: row column oriented algorithms, block oriented algorithms; parallel quicksort, hyper quicksort; solving linear systems: Gaussian elimination, Jacobi algorithm; parallel algorithm design strategies.

### Unit-V 08

**Developing Parallel Computing Applications:** Open MP implementation in 'C' and its execution model, memory model; **Directives:** Conditional compilation, internal control variables, parallel construct, work sharing constructs, combined parallel work-sharing constructs, master and synchronization constructs; **Run-Time Library Routines:** execution environment routines, lock routines, and timing routines.

#### Text Books:

1. Quinn, "Parallel Computing: Theory & Practice", TMH
2. Kai Hwang, "Advance Computer Architecture", TMH

#### Reference Books:

1. Matthew, "Beginning Linux Programming", SPD/WROX
2. Hennessy and Patterson, "Computer Architecture: A Quantitative Approach", Elsevier
3. Dezsó and Sima, "Advanced Computer Architecture", Pearson
4. Quinn, "Parallel Programming in C with MPI and Open MP", TMH

# CS - 604

## GRAPH THEORY

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>0</b>	<b>0</b>

**Unit-I** **08**

**Introduction:** Graphs, sub graphs, some basic properties, various example of graphs & their sub graphs, walks, path & circuits, connected graphs, disconnected graphs and component, Euler graphs, various operation on graphs, Hamiltonian paths and circuits, and the traveling sales man problem.

**Unit- II** **08**

**Trees and Fundamental Circuits:** Distance diameters, radius and pendent vertices, rooted and binary trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, Prim's and Kruskal's algorithm.

**Unit -III** **08**

**Cut Set and Planarity:** Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, network flows planer graphs, **Combinatorial and Geometric dual:** Kuratowski's graphs, detection of planarity, geometric dual, discussion on criterion of planarity, thickness and crossings.

**Unit -IV** **08**

**Vector Space and Matrix Representation:** Vector space of a graph and vectors, basis vector, cut set vector, circuit vector, circuit and cut set subspaces, matrix representation of graph – basic concepts; incidence matrix, circuit matrix, path matrix, cut-set matrix, and adjacency matrix.

**Unit -V** **08**

**Graph Coloring:** Coloring, covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic polynomials, matching, covering, and four color problem.

**Text Book:**

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI.

**Reference Books:**

1. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH.
2. Robin J. Wilson, Introduction to Graph Theory, Pearson Education.
3. Harary, F, Graph Theory, Narosa.

**CS - 651**  
**DESIGN AND ANALYSIS OF ALGORITHM LAB**

**L T P**  
**0 0 2**

**LIST OF PRACTICALS**

Write a program to implement the following-

1. Program for Recursive Binary & Linear Search.
2. Program for Heap Sort.
3. Program for Merge Sort.
4. Program for Selection Sort.
5. Program for Insertion Sort.
6. Program for Quick Sort.
7. Program for Shell Sort.
8. Program to implement Floyd-Warshall's algorithm.
9. Program for sum of subset algorithm.
10. Knapsack Problem using Greedy Solution
11. Perform Travelling Salesman Problem
12. Find Minimum Spanning Tree using Kruskal's Algorithm
13. Implement N Queen Problem using Backtracking

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**CS - 652**  
**COMPUTER NETWORKS LAB**

**L T P**  
**0 0 2**

**LIST OF PRACTICALS**

1. To study different types of network cables and implement cross wired and straight through cables (RJ-45 connector, Crimping Tool, Twisted pair Cable/CAT-6 cable).
2. To study various networking devices in detail such as repeaters, switches, bridges, hubs, routers etc.
3. Connect computers in LAN.
4. Performing an Initial Switch Configuration (Cisco Catalyst 2960 switch).
5. Performing an Initial Router Configuration (Cisco 1841 ISR Router).
6. Study of IP address classification.
7. Study of Subnetting and supernetting.
8. Running and using services/commands like ping, trace route, nslookup, arp, telnet, ftp, etc.
9. Network simulation using Cisco Packet Tracer tool.
10. Socket programming using TCP (e.g., data & time client/server, echo client/server, iterative & concurrent servers).
11. Socket programming using UDP (like simple DNS).
12. Simulation of Sliding Window Protocol.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

**CS - 6051**  
**SOFTWARE PROJECT MANAGEMENT**

**L T P**  
**3 0 0**

**Unit-I** **08**

**Introduction and Software Project Planning:** Fundamentals of software project management (SPM), need identification, vision and scope document, project management cycle, SPM objectives, management spectrum, SPM framework, software project planning, planning objectives, project plan, types of project plan, structure of a software project management plan, software project estimation, estimation methods, estimation models, and decision process.

**Unit-II** **08**

**Project Organization and Scheduling:** Project elements, work breakdown structure (WBS), Types of WBS, functions, activities and tasks, project life cycle and product life cycle, ways to organize personnel, project schedule, scheduling objectives, building the project schedule, scheduling terminology and techniques, **Network Diagrams:** PERT, CPM, Bar charts, Milestone charts, and Gantt charts.

**Unit-III** **08**

**Project Monitoring and Control:** Dimensions of project monitoring & control, earned value analysis, earned value indicators: budgeted cost for work scheduled (BCWS), cost variance (CV), schedule variance (SV), cost performance index (CPI), schedule performance index (SPI), interpretation of earned value indicators, error tracking, software reviews, types of review: inspections, desk checks, walkthroughs, code reviews, and pair programming.

**Unit-IV** **08**

**Software Quality Assurance and Testing:** Testing objectives, testing principles, test plans, test cases, types of testing, levels of testing, test strategies, program correctness, program verification & validation, testing automation & testing tools, concept of software quality, software quality attributes, software quality metrics and indicators, the SEI capability maturity model (CMM), SQA activities, formal SQA approaches: proof of correctness, statistical quality assurance, and clean room process.

**Unit-V** **08**

**Project Management and Project Management Tools:** Software configuration management: software configuration items and tasks, baselines, plan for change, change control, change requests management, version control, risk management: risks and risk types, risk breakdown structure (RBS), risk management process: risk identification, risk analysis, risk planning, risk monitoring, cost benefit analysis, software project management tools: CASE tools, planning and scheduling tools, and MS-project.

**Text Books:**

1. M. Cotterell, Software Project Management, Tata McGraw Hill Publication.
2. S. A. Kelkar, Software Project Management, PHI Publication.

**Reference Books:**

1. Royce, Software Project Management, Pearson Education
2. Kieron Conway, Software Project Management, Dreamtech Press

**CS - 6052**  
**MULTIMEDIA SYSTEMS**

**L T P**  
**3 0 0**

**Unit-I** **09**

**Introduction:** Multimedia, multimedia information, multimedia objects, multimedia in business and work, convergence of computer, communication and entertainment products, stages of multimedia projects, multimedia hardware, memory & storage devices, communication devices, multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

**Unit-II** **06**

**Multimedia Building Blocks:** Text, sound MIDI, digital audio, audio file formats, MIDI under windows environment, audio & video capture.

**Unit-III** **09**

**Data Compression:** Huffman coding, Shannon fano algorithm, Huffman algorithms, adaptive coding, arithmetic coding, higher order modelling, finite context modelling, dictionary based compression, sliding window compression, LZ77, LZW compression, compression ratio, lossless & lossy compression.

**Unit-IV** **06**

**Speech Compression & Synthesis:** Digital audio concepts, sampling variables, lossless compression of sound, lossy compression & silence compression.

**Unit-V** **10**

**Images:** Multiple monitors, bitmaps, vector drawing, lossy graphic compression, image file format animations, images standards, JPEG compression, Zig-Zag coding, multimedia database, content based retrieval for text and images. **Video:** Video representation, colors, video compression, MPEG standards, MHEG standard video streaming on net, video conferencing, multimedia broadcast services, indexing and retrieval of video database, and recent development in multimedia.

**Text Books:**

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
2. Buford "Multimedia Systems" Addison Wesley.
3. Agrawal & Tiwari "Multimedia Systems" Excel.

**Reference Books:**

1. Mark Nelson "Data Compression Book" BPB.
2. David Hillman "Multimedia technology and Applications" Galgotia Publications.
3. Rosch "Multimedia Bible" Sams Publishing.
4. Sleinreitz "Multimedia System" Addison Wesley.

**CS - 6053**  
**SOFTWARE TESTING & AUDIT**

**L T P**  
**3 0 0**

**Unit-I** **08**

**Introduction:** Software development life cycle, testing process, terminologies in testing: error, fault, failure, test cases, testing suite, test oracles, impracticality of testing all data, and impracticality of testing all paths.

**Audit:** Verification, verification methods, validation, validation methods, evolutionary nature of verification and validation, difference between verification and validation. SRS verification, source code reviews, user documentation verification, software project audit, tailoring software quality assurance program by reviews, walkthrough, inspection, and configuration audits.

**Unit-II** **08**

**Functional Testing:** Boundary value analysis, equivalence class testing, decision table based testing, and cause effect graphing technique.

**Structural Testing:** Control flow testing, path testing, independent paths, generation of graph from program, identification of independent paths, cyclomatic complexity, data flow testing, and mutation testing.

**Unit-III** **08**

**Regression Testing:** Concept, regression test cases selection, reducing the number of test cases, and code coverage prioritization technique.

**Reducing the number of test cases:** Prioritization guidelines, priority category, scheme, and risk analysis.

**Unit-IV** **08**

**Software Testing Activities:** Levels of testing, debugging, testing techniques and their applicability, and exploratory testing

**Automated Test Data Generation:** Test data, approaches to test data generation, test data generation using genetic algorithm, test data generation tools, software testing tools, and software test plan.

**Unit-V** **08**

**Object oriented Testing:** Definition, issues, class testing, object oriented integration and system testing.

**Testing Web Applications:** What is Web testing?, user interface testing, usability testing, security testing, performance testing, database testing, and post deployment testing.

**Text Books:**

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.

**Reference Books:**

1. Roger S. Pressman, "Software Engineering -A Practitioner's Approach", Fifth Edition, McGraw Hill International Edition, New Delhi, 2001.
2. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.

**CS - 6054**  
**E - COMMERCE**

**L T P**  
**3 0 0**

**Unit-I** **08**

**Introduction:** Definition of electronic commerce, **E-Commerce:** Technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, impact of E-commerce on business, and E-Commerce models.

**Unit-II** **08**

**Network Infrastructure for E- Commerce:** Internet and intranet based E-commerce- Issues, problems and prospects, network infrastructure, network access equipment's, and broadband telecommunication (ATM, ISDN, FRAME RELAY). **Mobile Commerce:** Introduction, wireless application protocol, WAP technology, and mobile information device.

**Unit-III** **08**

**Web Security:** Security issues on web, importance of firewall, components of firewall, transaction security, emerging client server, security threats, network security, factors to consider in firewall design, limitation of firewalls.

**Unit-IV** **08**

**Encryption:** Encryption techniques, symmetric encryption: keys and data encryption standard, triple encryption, secret key encryption; asymmetric encryption: public and private pair key encryption, digital signatures, and virtual private network.

**Unit-V** **08**

**Electronic Payments:** Overview, the SET protocol, payment gateway, certificate, digital tokens, Smart card, credit card, magnetic strip card, E-Checks, credit/debit card based EPS, online banking. EDI application in business, E- Commerce law, forms of agreement, govt. policies and agenda.

**Text Book:**

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison-Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH

**Reference Books:**

1. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education.
2. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education



**CS - 6055**  
**WEB MINING**

**L T P**  
**3 0 0**

**Unit-I** **08**

**Overview:** Purpose, Content, type of data on web, structured and unstructured data, structure and usage mining, web crawling, and indexing.

**Unit-II** **08**

**Text and Image Mining:** Text analysis and classification, text mining, image and multimedia mining, link analysis, and ranking algorithms.

**Unit-III** **08**

**Information Retrieval:** Web search and retrieval of information, web semantics, clustering/community algorithms, and topical locality.

**Unit-IV** **08**

**Growth Models:** Web growth models and web traffic models, traffic analysis, log, traffic graph, and web server log analyzer.

**Unit-V** **08**

**Social tagging:** Social networks, social media, and Information diffusion.

**Text Book:**

1. Russell Matthew A., Mining the Social Web, Shroff Publishers & Distributors Pvt Ltd.

**Reference Books:**

1. Anthony Scime, Web Mining: Applications and Techniques, Idea Group Publishing.
2. Guandong Xu, Yanchun Zhang, Web Mining and Social Networking- Techniques and Applications, Springer.

**CS - 6056**  
**DATA COMPRESSION**

**L T P**  
**3 0 0**

**Unit - I** **08**

**Compression Techniques:** Lossless compression, lossy compression, modeling and coding, **Mathematical Preliminaries for Lossless Compression:** A brief introduction to information theory, models: physical models, probability models, markov models, composite source model, Coding: uniquely decodable codes, and prefix codes.

**Unit – II** **08**

**The Huffman coding algorithm:** Minimum variance huffman codes, adaptive huffman coding: update procedure, encoding procedure, decoding procedure, applications of huffman coding: lossless image compression, text compression, and audio compression.

**Unit-III** **08**

**Arithmetic Coding:** Coding a sequence, generating a binary code, comparison of binary and huffman coding, **Applications:** Bi-level image compression-the JBIG standard, JBIG2, image compression. **Dictionary Techniques:** Introduction, static dictionary: diagram coding, Adaptive dictionary, LZ77 approach, LZ78 approach, and applications.

**Unit – IV** **08**

**Mathematical Preliminaries for Lossy Coding:** Distortion criteria, models, **Scalar Quantization:** The quantization problem, uniform quantizer, adaptive quantization, and non-uniform quantization.

**Unit-V** **08**

**Vector Quantization:** Advantages of vector quantization over scalar quantization, the Linde-Buzo-Gray algorithm, tree structured vector quantizers, and structured vector Quantizers.

**Text Books:**

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers.

**Reference Books:**

1. Drozdek, Elements of Data Compression, Cengage Learning
2. David Salomon, Data Compression: The Complete Reference, 4th Edition Springer
3. Timothy C. Bell, Text Compression, 1st Edition Prentice Hall.