

M. TECH (COMPUTER SCIENCE & ENGINEERING)

SEMESTER II

Paper Code	Paper Name	Weekly Contact Paper Period (WCP)				Marks
		Lecture	Tutorial	Practical	Total	
Theoretical:						
MTCSE220	Advanced Database System	3	0	0	3	100
MTCSE221	Advanced Operating Systems	3	0	0	3	100
MTCSE222	Network Security	3	0	0	3	100
MTCSE223	Cloud Computing	3	0	0	3	100
E1	Elective 1	3	0	0	3	100
Practical:						
MTCSE225	Operating System Lab	0	0	2	2	50
MTCSE226	Network Security Lab	0	0	2	2	50
MTCSE227	Advanced DBMS Lab	0	0	2	2	50
Total Marks=650						

Elective 1 (II Semester)

Paper Code	Paper Name
MTCSE2340	Distributed Computing
MTCSE2341	Soft Computing
MTCSE2342	Multimedia System
MTCSE2343	Web Technology

ADVANCED DATABASE SYSTEMS

MTCSE220

UNIT 1

DBMS Concept introduction, data models, E-R diagram, Keys, Relational database schemas, Integrity constraints, Relational algebra and calculus, Normalization, Normal form.

UNIT II

Indexing, Query processing and optimization, Concurrency control. Distributed database: fragmentation, Transparency, Distributed query processing and optimization, Distributed transaction modal and concurrency control, Distributed deadlock and commit protocol.

UNIT III

Object oriented and object relational databases: Specialization, Generalization, Aggregation and Association, Object identity, Architecture of object oriented and object relational databases.

UNIT IV

Web databases: Accessing databases through web, Web server, XML database.

UNIT V

Introduction to image and multimedia database and data structure, Data structure, R Tree, K-D tree, Quad tree, Content based retrieval: color histogram.

Reference Books:

1. R. Elmasri, S. Navathe, Benjamin Cumming, Fundamentals of Database system.
2. H.F. Korth and A. Silberschatz, Database concept, (II ed) McGraw Hill, 1991
3. C.J. Date, An Introduction to Database System Volume I (V ed), Addison Wesley
4. Narang, Object Oriented Database, Prentice – Hall of India, New Delhi.
5. W. Kim “Modern Database System”, 1995, Acin Press, Addison – Wesley.

ADVANCED OPERATING SYSTEM

MTCSE221

UNIT I

Multiprocessor operating system - Multiprocessor system architecture, Structure, Processor scheduling and allocation, Memory management.

UNIT II

Distributed operating system: Characteristics, Design issues, Communication models, Clock synchronization, Mutual exclusion Election Algorithms.

UNIT III

Distributed Deadlocks detection, Distributed scheduling, Distributed File system, Distributed shared memory.

UNIT IV

Multimedia Files, Video compression, Process Scheduling, File System, File placement, Caching, Disk Scheduling.

UNIT V

Real Time Operating System: Scheduling mechanisms, Interrupts, Memory management, I/O & networking, resource reservation.

Case studies: Open source software, LINUX, Open SOLARIS, Amoeba, Mach, chorus etc.

TEXT BOOK

1. M Singhal and NG Sivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc., 2001
2. A.S. Tanenbaum, Distributed Operating system, Pearson Education Asia, 2001.

REFERENCE BOOK

1. SILBERSCHATZ and P. GALVIN, Operating System Concepts, VI **edition**, Addison Wesley 2004.

NETWORK SECURITY

MTCSE222

UNIT I

Introduction to Classical and Modern techniques - Attacks, services and mechanisms, Classical encryption techniques, DES, Block cipher design principles and modes of operation.

UNIT II

Encryption Algorithms and Hash Functions - Triple DES, RC5, Key management, Public key. Cryptography RSA Algorithm, Digital signatures and authentication protocols.

UNIT III

System Security - Backups, Integrity management, Protecting against programmed threats, Viruses and worms, Physical security, Personnel security.

UNIT IV

Network Security - Protection against eavesdropping, Security for modems, IP security, Web security, Electronic mail security, Authentication applications.

UNIT V

Security tools - Firewalls, Wrappers, Proxies, Discovering a break-in, Denial of service attacks and solutions, Cryptographic security tools: KERBEROS, PGP, SSH, SRP, OPIE.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security Principles and Practice ", 11 Edition, Pearson Education Asia Publishers (Low priced Edition), 2000, Ch 1 to 16.
2. Simson Garjainkal, and Gene Spafford, "Practical UNIX and Internet Security" 2nd edition O'Reilly Pte Pvt. Ltd. 2000

REFERENCE BOOK

1. Steve Burnett and Stephene Paine, "RSA Security 's official guide to cryptography", RSA Press, Tata McGraw Hill Edition, 2001.

CLOUD COMPUTING

MTCSE223

UNIT I

Cloud Computing- History of cloud computing- Cloud architecture- Cloud storage-Cloud computing matters- Advantages of cloud computing-Disadvantages of cloud computing- Companies in the cloud today- Cloud services.

UNIT II

Web Based application- Pros and Cons of Cloud service development- Types of cloud service development- Software as a service- Platform as service- Web services- On-Demand computing- Discovering cloud services-Development services and tools- Amazon EC2- Google App engine- IBM clouds.

UNIT III

Centralizing emails communications- Collaborations on schedules- Collaborating on To-do lists- Collaborating contacts lists-Cloud computing for the community- Collaborating on group projects and events- Cloud computing for the corporation.

UNIT IV

Collaborating on calendars, Schedules and Task Management- Exporting online scheduling applications-Exploring online planning and Task management- Collaborating on event management- Collaborating on contact management- Collaborating on project management- Collaborating on word processing, Collaborating on database, Storing and sharing files.

UNIT V

Collaborating via Web-Based communication tools, Evaluating web mail services, Evaluating web conference tools, Collaborating via Social Networks and Groupware, Collaborating via Blogs and Wikis.

REFERENCES

1. Michael Miller, "Cloud Computing: Web-Based applications that change the way you work and Collaborate Online", Que Publishing, 2008.
2. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for on-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, 2008.

OPERATING SYSTEM LAB MTCSE225

MULTIPROCESSOR OPERATING SYSTEMS

PROGRAM 1 – Semaphores - Multiprocessor operating systems

Assume there are three processes: P_a , P_b , and P_c . Only P_a can output the letter A, P_b B, and P_c C. Utilizing only semaphores (and no other variables) the processes are synchronized so that the output satisfies the following conditions:

- a) A B must be output before any C's can be output.
- b) B's and C's must alternate in the output string, that is, after the first B is output, another B cannot be output until a C is output. Similarly, once a C is output, another C cannot be output until a B is output.
- c) The total number of B's and C's which have been output at any given point in the output string cannot exceed the number of A's which have been output up to that point.

Examples

AACB -- invalid, violates a)

ABACAC -- invalid, violates b)

AABCABC -- invalid, violates c)

AABCAAABC -- valid

AAAABCBC -- valid

AB – valid

PROGRAM 2 – Multithreading - Multiprocessor operating systems

The Cigarette Smokers Problem

Consider a simulation with three *smoker* threads and one *agent* thread. Each smoker continuously makes a cigarette and smokes it. But to make a cigarette, a smoker needs three ingredients: tobacco, paper, and matches. One of the smoker threads has only paper, another has only tobacco and the third has only matches. The agent thread has an infinite supply of all three materials. The three smoker threads are initially blocked. The agent places two randomly chosen (different) ingredients on the table and unblocks the one smoker who has the remaining ingredient. The agent then blocks. The unblocked smoker removes the two ingredients from the table, makes a cigarette, and smokes it for a random amount of time, unblocking the agent on completion of smoking the cigarette. The agent then puts out another random two of the three ingredients, and the cycle repeats.

Write a multi-class multithreaded Java program that uses a monitor to synchronize the agent thread and the three smoker threads. **Do not mechanically translate semaphore code into monitor code!** The agent thread executes in an agent object created from an agent class. Each smoker thread executes in a smoker object. All smoker objects are created from one smoker class whose constructor is used to specify the ingredient possessed by the smoker object. A driver class with a main method constructs the objects and starts the threads.

Use a single monitor object instantiated from a class Control for synchronization. Each of the four threads invokes a synchronized monitor method for its synchronization. No semaphores are allowed. No synchronized blocks are allowed, only synchronized methods. No busy waiting is allowed. No calls to nap inside a synchronized method are allowed (do not nap while holding the monitor object's lock, that is, while inside a synchronized method or while inside a method called by a synchronized method).

PROGRAM 3 – Multiple sleeping barbers - Multiprocessor operating systems

Write a multi-class multithreaded Java program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single Customer class, each barber is instantiated from a single Barber class.

Network operating systems

PROGRAM 4 – Network operating systems

Establish a Lab setup for the following network operating systems based programs based on the skills in networking on your own. E.g. for identifying networking hardware, identifying different kinds of network cabling and network interface cards can be done.

Exercises

1. Identifying Local Area Network Hardware
2. Exploring Local Area Network Configuration Options
3. Verifying TCP/IP Settings
4. Sharing Resources
5. Testing LAN Connections

Real time operating systems

PROGRAM 5 – Real time operating systems

A real-time program implementing an alarm clock shall be developed.

[Alarm clock, using C and Simple_OS]

The program shall fulfill the following requirements:

Clock with alarm functionality shall be implemented, It shall be possible to set the time, It shall be possible to set the alarm time, the alarm shall be *enabled* when the alarm time is set, the alarm shall be *activated* when the alarm is enabled, and when the current time is equal to the alarm time, an activated alarm must be acknowledged. Acknowledgement of an alarm shall lead to the alarm being *disabled*, the alarm is enabled again when a new alarm time is set, an alarm which is not acknowledged shall be repeated every 10 seconds. The program shall communicate with a graphical user interface, where the current time shall be displayed, and where the alarm time shall be displayed when the alarm is enabled. It shall be possible to terminate the program, using a command which is sent from the graphical user interface.

Database operating systems

PROGRAM 6 – Transactions and Concurrency -Database operating systems

Exercises

Assume any application (e.g. banking) on your own and do the following exercises.

1. Investigate and implement the Object Store's concurrency options.
2. Implement the concurrency conflict that occurs between multiple client applications.
3. Observe and implement the implication of nested transactions.

Distributed operating systems

PROGRAM 7 – Distributed operating systems

1. Design a RMI Lottery application. Each time you run the client program -- “**java Lottery Client n**”, the server program “**Lottery Server**” will generate **n** set of Lottery numbers. Here **n** is a positive integer, representing the money you will spend on Lottery in sterling pounds. Write this program in a proper engineering manner, i.e. there should be specifications, design (flow chart, FD, or pseudo code), coding, test/debug, and documentation.
2. Consider a distributed system that consists of two processes which communicate with each other. Let **P** be a state predicate on the local state of one process and **Q** be a state predicate on the local state of the other process. Assume that neither **P** nor **Q** are stable (i.e. closed).

Design a superimposed computation which detects that there exists an interleaving of underlying events in this system where at some state $P \wedge Q$ holds. (A superposed computation is one that does not act the underlying system; it may \read" but not\write" the state of the underlying system. Events in a superposed computation may occur in at the same instant as the underlying events and/or at different instants.) State any assumptions you make. [Hint: Use vector clocks.]

NETWORK SECURITY LAB MTCSE226

Programs, assignments covering the need of Network Security (MTCSE222)

ADVANCED DBMS LAB
MTCSE227

Topic: **Distributed databases**

Software used: Oracle 9.2

1. Create a global conceptual schema Emp(Eno;Ename;Address;Email;Salary) and insert 10 records. Divide Emp into vertical fragments Emp1(Eno;Ename;Address) and Emp2(Eno;Email;Salary) on two different nodes. Fire the following queries:
 - (i) Find the salary of an employee where employee number is known.
 - (ii) Find the Email where the employee name is known.
 - (iii) Find the employee name and Email where employee number is known.
 - (iv) Find the employee name whose salary is > 2000.
2. Create a global conceptual schema Emp(Eno;Ename;Address;Email;Salary) and insert 10 records. Divide Emp into horizontal fragments using the condition that Emp1 contains the tuples with salary = 10,000 and Emp2 with 10,000 < salary = 20,000 on two different nodes. Fire the following queries:
 - (i) Find the salary of all employees.
 - (ii) Find the Email of all employees where salary = 15,000
 - (iii) Find the employee name and Email where employee number is known.
 - (iv) Find the employee name and address where employee number is known.
3. Create a global conceptual schema Emp(Eno;Ename;Address;Email;Salary) and insert 10 records. Store the replication of Emp into two different nodes and fire the following queries:
 - (i) Find the salary of all employees.
 - (ii) Find the Email of all employees where salary = 15,000
 - (iii) Find the employee name and Email where employee number is known.
 - (iv) Find the employee name and address where employee number is known.

Topic: **Object Oriented Databases**

Software used: Oracle 9.2

4. Using Object Oriented databases create the following types:
 - a) AddrType1 (Pincode: number, Street :char, City : char, state :char)
 - b) BranchType (address: AddrType1, phone1: integer, phone2: integer)
 - c) AuthorType (name:char,,addr AddrType1)
 - d) PublisherType (name: char, addr: AddrType1, branches: BranchTableType)
 - e) AuthorListType as array, which is a reference to AuthorType

Next create the following tables:

- f) BranchTableType of BranchType
- g) authors of AuthorType
- h) books(title: varchar, year : date, published_by ref PublisherType, authors AuthorListType)
- i) Publishers of PublisherType

Insert 10 records into the above tables and fire the following queries:

- a) List all of the authors that have the same pin code as their publisher:
- b) List all books that have 2 or more authors:
- c) List the name of the publisher that has the most branches
- d) Name of authors who have not published a book
- e) List all authors who have published more than one book:
- f) Name of authors who have published books with at least two different publishers
- g) List all books (title) where the same author appears more than once on the list of authors (assuming that an integrity constraint requiring that the name of an author is unique in a list of authors has not been specified).

Topic: Multimedia Database

Software used: Oracle 9.2, J2SDK 1.4.2, Java Media Framework 2

5. [A] Create a table Emp with the attributes Eno as employee number, Ename as employee name, Eaddress as employee address and photo as an employee picture. Also create a table Company with attributes Eno, designation and age. Fire the following queries
 - a) Find name and designation of all the employees
 - b) Find name and age of all the employees
 - c) Find name and photo of a particular employee[B] Create a table Singer with the attributes sno as singer number, Sname as singer name, Saddress as singer address and audio as an audio clip. Also create a table Company with attributes Sno,age. Fire the following queries
 - a) Find name and age of all the singer
 - b) Find name and audio clip of a particular singer[C] Create a table Singer with the attributes sno as singer number, Sname as singer name, Saddress as singer address and video as an audio clip. Also create a table Company with attributes Sno, age. Fire the following queries
 - a) Find name and age of all the singer
 - b) Find name and video clip of a particular singer

Topic: Temporal Databases

Software used: Oracle 9.2

6. [A] Create a table tblEmp_Appnt, which stores the account number, name, and valid time say, recruitment date and retirement date. Insert 10 records and fire the following queries
 - a) Find all the employees who join the company on 2/3/2011
 - b) Find all the employees who will retired on 2/3/2011[B] Create a table tbl_shares, which stores the, name of company, number of shares, and price per share at transaction time. Insert 10 records and fire the following queries
 - a) Find all the names of a company whose share price is more than Rs. 100 at 11:45 A.M.
 - b) Find the name of company which has highest share price at 5.00 P.M.[C] Create a table tblEmp_Appnt, which stores the account number, name, and valid time say, recruitment date and retirement date. Create a trigger for valid time to check that no two records

of same employee have common employment period and does not allow the user to update the records. Trigger should also fill up the empty retirement date.

Topic: Active Databases

Software used: Oracle 9.2

7. Create a table emp (eno, ename, hrs, pno, super_no) and project (pname, pno, thrs, head_no) where this is the total hours and is the derived attribute. Its value is the sum of hrs of all employees working on that project. eno and pno are primary keys, head_no is foreign key to emp relation. Insert 10 tuples and write triggers to do the following:
 - a) Creating a trigger to insert a new employee tuple and display the new total hours from project table.
 - b) Creating a trigger to change the hrs of existing employee and display the new total hours from project table.
 - c) Creating a trigger to change the project of an employee and display the new total hours from project table.
 - d) Creating a trigger to deleting the project of an employee.

Topic: XML databases

Software used: Oracle 9.2

8. Create a table employee having dept_id as number datatype and employee_spec as XML datatype (XMLType).The employee_spec is a schema with attributes emp id, name, email, acc_no, managerEmail, dateOf Joining. Insert 10 tuples into employee table. Fire the following queries on XML database.
 - a) Retrieve the names of employee.
 - b) Retrieve the acc_no of employees.
 - c) Retrieve the names,acc_no, email of employees.
 - d) Update the 3rd record from the table and display the name of an employee.
 - e) Delete 4 th record from the table.

Topic: Spatial databases

Software used: Oracle 9.2

9. Create a spatial database table that stores the number, name and location, which consists of four different areas say abc, pqr, mno and xyz. Fire the following queries
 - a) Find the topological intersection of two geometries.
 - b) Find whether two geometric figures are equivalent to each other.
 - c) Find the areas of all different locations.
 - d) Find the area of only one location.Find the distance between two geometries

DISTRIBUTED COMPUTING

MTCSE2340

UNIT I

COMMUNICATION IN DISTRIBUTED ENVIRONMENT

Introduction – Various Paradigms in Distributed Applications – Remote Procedure Call – Remote Object Invocation – Message-Oriented Communication – Unicasting, Multicasting and Broadcasting – Group Communication.

UNIT II

DISTRIBUTED OPERATING SYSTEMS

Issues in Distributed Operating System – Threads in Distributed Systems – Clock Synchronization – Causal Ordering – Global States – Election Algorithms – Distributed Mutual Exclusion – Distributed Transactions – Distributed Deadlock – Agreement Protocols .

UNIT III

DISTRIBUTED RESOURCE MANAGEMENT

Distributed Shared Memory – Data-Centric Consistency Models – Client-Centric Consistency Models – Ivy – Munin – Distributed Scheduling – Distributed File Systems – Sun NFS.

UNIT IV

FAULT TOLERANCE AND CONSENSUS

Introduction to Fault Tolerance – Distributed Commit Protocols – Byzantine Fault Tolerance – Impossibilities in Fault Tolerance.

UNIT V

CASE STUDIES

Distributed Object-Based System – CORBA – COM – Distributed Coordination-Based System – JINI.

REFERENCES:

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Third Edition, Pearson Education Asia, 2002.
2. Hagit Attiya and Jennifer Welch, “Distributed Computing: Fundamentals, Simulations and Advanced Topics”, Wiley, 2004.
3. Mukesh Singhal, “Advanced Concepts In Operating Systems”, McGrawHill Series in Computer Science, 1994.
4. A.S.Tanenbaum, M.Van Steen, “Distributed Systems”, Pearson Education, 2004.
5. M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, 2004.

SOFT COMPUTING

MTCSE2341

UNIT I

INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics.

UNIT II

GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning, Machine Learning Approach to Knowledge Acquisition. Chromosome representation, Encoding, Decoding, Genetic operators: Selection, Crossover, Mutation, Elitism, Schema Theorem, EGA, Convergence theorem, real-coded GA, Ordered GA, Steady-state GA, Multi-objective evolutionary algorithms, Applications in search and optimization. Recent advances in Evolutionary Computing (Particle Swarm Optimization, Ant Colony Optimization).

UNIT III

NEURAL NETWORKS

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT IV

FUZZY LOGIC

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT V

NEURO-FUZZY MODELING

Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees , Data Clustering Algorithms, Rule base Structure Identification, Neuro-Fuzzy Control, Case studies.

TEXT BOOKS:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.

REFERENCES:

1. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer, 2007.
4. S.N.Sivanandam · S.N.Deepa, “ Introduction to Genetic Algorithms”, Springer, 2007.
5. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishers, 1992.

MULTIMEDIA SYSTEMS

MECSE2342

UNIT I

INTRODUCTION AND QOS

Introduction-QOS Requirements and Constraints-Concepts-Resources- Establishment Phase-Run-Time Phase-Management Architectures.

UNIT II

OPERATING SYSTEMS

Real-Time Processing-Scheduling- Inter process Communication-Memory and Management-Server Architecture-Disk Management.

UNIT III

FILE SYSTEMS AND NETWORKS

Traditional and Multimedia File Systems-Caching Policy-Batching-Piggy backing-Ethernet-Gigabit Ethernet-Token Ring-100VG Any LAN-Fiber Distributed Data Interface (FDDI)- ATM Networks-MAN-WAN.

UNIT IV

COMMUNICATION

Transport Subsystem-Protocol Support for QOS-Transport of Multimedia-Computer Supported Cooperative Work-Architecture-Session Management-M Bone Applications.

UNIT V

SYNCHRONIZATION

Synchronization in Multimedia Systems- Presentation-Synchronization Types-Multimedia Synchronization Methods-Case Studies-MHEG-MODE-ACME.

TEXT BOOKS:

1. Ralf Steinmetz and Klara Nahrstedt, "Multimedia Systems", Springer, I Edition 2004.

REFERENCES:

1. Ralf Steinmetz and Klara Nahrstedt , Media Coding and Content Processing, Prentice hall, 2002.
2. Vaughan T, Multimedia, Tata McGraw Hill, 1999.
3. Mark J.B., Sandra K.M., Multimedia Applications Development using DVI technology, McGraw Hill, 1992.
4. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovacovic, D. A. Milovacovic , Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice Hall, 1st Edition, 2002
5. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson, 2004

WEB TECHNOLOGY

MTCSE2343

UNIT I

Web essentials – clients – servers - communication – markup languages – XHTML – simple XHTML pages style sheets – CSS.

UNIT II

Client side programming – Java script language – java script objects – host objects: Browsers and the DOM.

UNIT III

Server side programming – java servlets – basics – simple program – separating programming and presentation – ASP/JSP - JSP basics ASP/JSP objects – simple ASP/JSP pages.

UNIT IV

Representing Web data – data base connectivity – JDBC – Dynamic Web pages – XML – DTD – XML schema – DOM – SAX – XQuery.

UNIT V

Building Web applications - cookies – sessions – open source environment – PHP – MYSQL – case studies.

TEXT BOOKS:

1. Jeffrey C Jackson, “Web Technology – A computer Science perspective”, Persoson Education, 2007.
2. Chris Bates, “Web Programming – Building Internet Applications, “Wiley India, 2006.