Course Name: **MCA 2nd Semester**

Subject Code: **CS-4405**

Subject Name: **Database Management System**

Aim of the Subject

The student should learn database design and information retrieval concepts and apply these concepts in complex projects involving large database.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Conceptual clarity on database systems and their evaluation
- theoretical foundation of query languages through relational algebra and relational calculus
- Database design issues from ER model to normalization
- proficiency in SQL, PLSQL & NoSQL through case studies
- exposure to advance topics like transaction management, concurrency control and physical data storage

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Unit 1

Introduction and Relational Model: Advantages of DBMS approach, various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator &user, data dictionary, database structure & architectures. Relational Model: Domains, relation, kind of relation, Relational databases, Various types of keys: candidate, primary, alternate & foreign keys, relational algebra with fundamental and extended operations, modification of database.

Unit 2

ER Model and SQL: Basic concept, design issues, mapping constraint, keys, ER diagram, weak& strong entity-sets, specialization & generalization, aggregation, inheritance, design of ER schema, Reduction of ER Schema to tables. SQL: Basic structure of SQL, Set operation, Aggregate functions, Null values, Nested Sub queries, derived relations, views, Modification of database, join relation, Domain,

relation & keys, DDL in SQL. Programming concepts of PL/SQL, Stored procedure. The concept of NoSQL, Brief history of NoSQL, SQL verses NoSQL, CAP Theorem (Brewer's Theorem), NoSQL pros/cons,Categories of NoSQL database, Production deployment, MongoDb, Key Features, practical with MongoDb.

Unit 3

Functional Dependencies: Basic definitions, Trivial & non trivial dependencies, closure set of dependencies & of attributes, Irreducible set of dependencies, FD diagram. Normalization: Introduction to normalization, non loss decomposition, First, second and third normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, join dependencies and fifth normal form.

Unit 4

Transaction Management: Basic concept, ACID properties, transaction state, Implementation of atomicity & durability, Concurrent execution, Basic idea of serializability. Concurrency & Recovery: Basic idea of concurrency control, the basic idea of deadlock, Failure Classification, storage structure-types, stable storage implementation, data access, recovery & Atomicity: log based recovery, deferred database modification, immediate database modification, checkpoints.

Unit 5

Database Integrity, Storage Structure & File Organization: general idea, integrity rules, Domain rules, Attributes rules, assertion, trigger, integrity & SQL. Storage Structure: overview of physical storage media, magnetic disk: performance & optimization, RAID. File Organization: File organization, Organization of records in files, the basic concept of Indexing, ordered indices: B+ tree & B tree index files.

Text Book(s)

1. Database System concepts –Henry F. Korth , Tata McGraw Hill 6th Edition.

Reference Material(s)

1. "Fundamentals of Database Systems", Elmasri R, Navathe S, Addison Wesley 4th Ed.

2. An introduction to database system-Bipin C. Desai, Galgotia Revised Edition

3. An introduction to Database System -C.J Date, Pearson 8th Ed.

4. SQL, PL/SQL The programm

Course Name: **MCA 2nd Semester**

Subject Code: **CS-4305**

Subject Name: **Software Engineering**

Aim of the Subject

Enable students to develop softwares using software develop life cycle

Learning Outcomes

The students are expected to learn following after completion of the course:

- Application of software engineering approaches in software development.
- Ability to paln and estimate software projects.
- analysis ans design software as function oriented and Object Oreinted Manner
- Produce quality software using testing and quality assurance mechanisms and
- approaches to software maintenance

Unit 1

Introduction to Software Engineering and Software Processes: Software, Software Classifications and Characteristics, Software Crisis, What is Software Engineering? System Engineering Vs. Software Engineering, Software Engineering Challenges. Software Processes: Process model, Elements and Characteristics of Process model, Process Classification, Software Development Processes: SDLC, Waterfall model, Iterative Waterfall model, Prototyping model, Incremental model, Spiral model, RAD model, Agile Software Development: Principles, Practices & Methods; RUP process model, Component-Based Development model etc.

Unit 2

Project Management and Planning: Project management essentials, Project success and failures, Project Life Cycle, Project team structure and organization, Software Configuration Management, Risk Management. Project planning activities: Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques, Staffing and Personnel Planning, Project Scheduling and Miscellaneous Plans.

Unit 3

Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation. Requirements Analysis: Structured Analysis, Object-oriented Analysis. Requirements Specification, Requirements Validation, and Requirements Management.

Unit 4

Software Design and Coding: Software Design Process, Characteristics of a Good Design, Design Principles, Modular Design (Coupling and Cohesion). Software Architecture. Design Methodologies: Function-oriented Design (Structured Design Methodology) and Object-oriented Design using UML, Logical Design. Coding principles, Coding process, Code verification and documentations.

Unit 5

Software Testing, Quality and Maintenance: Testing Fundamentals, Test Planning, Black-Box Testing, White-Box Testing, Levels of Testing, Usability Testing, Regression Testing, Program Slicing, Debugging Approaches. Quality Concept, Quality Factors, Verification and Validation, Quality Assurance Activities, Quality Standards: Capability Maturity Model (CMM), ISO 9000, Six Sigma. Best practices of Software Engineering. Software Reliability, Software Maintenance, Evolution, and Reengineering.

Text Book(s)

1. Software Engineering: Concepts & Practices- Ugrasen Suman, Cengage Learning, 2nd Edition.

2. Fundamentals of Software Engineering-Rajib Mall, PHI, New Delhi.

3. Object Oriented Analysis and Design Using UML, Ugrasen Suman et al, Cengage Learning.

Reference Material(s)

1. An Integrated Approach to Software Engineering- Pankaj Jalote, Narosa Publishing House.

2. Software Engineering-A practitioner's approach- R. S. Pressman, Tata

McGraw-Hill International Editions, New York.

3. Object Oriented Analysis and Design with A

Course Name: **MCA 2nd Semester**

Subject Code: **CS-5216**

Subject Name: **Design and Analysis of Algorithm**

Aim of the Subject

The aim is to teach the basic concepts of algorithms.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Exposure to various algorithm techniques like divide and conquer, dynamic &greedy and their application in real life problem solving.
- strong foundation on various graph algorithms and their applications.
- overview of NP complete problem and their equivalant alternative approximate
- algorithms.

Unit 1

Recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case complexity

Unit 2

Divide and Conquer: Integer multiplication revisited with an efficient algorithm that motivates and leads into recurrences. Solving recurrences using recurrence trees, repeated substitution, statement of master theorem. Brief recall of merge sort and its recurrence. Median in worst case linear time.

Unit 3

Application of Graph Traversal Techniques: Recall representation of graphs, BFS (as a method for SSSP on unweighted graphs), DFS, connected components, topological sorting of DAGs, biconnected components, and strongly connected components in directed graphs Greedy Algorithms: Greedy choice, optimal substructure property, minimum spanning trees -- Prims and Kruskals, Dijkstra's shortest path using arrays and heaps, fractional knapsack, and Huffman coding (use of priority queue).

Unit 4

Dynamic Programming: Integral knapsack (contrasted with the fractional variant), longest increasing subsequence, Edit distance, matrix chain multiplication, and independent sets in trees. (The instructor may choose a subset that fits within the time frame.)

Unit 5

NP-completeness: reduction amongst problems, classes NP, P, NP-complete, and polynomial time reductions

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Text Book(s)

1 Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein, MIT Press, Third Edition, 2009. [CLRS]

Reference Material(s)

1 Algorithms, by Dasgupta, Papadimitrou and Vazirani, McGraw-Hill Education, 2006.

2 Computer Algorithms, by Horowitz, Sahni, and Rajasekaran, Silicon Press, 2007.

Course Name: **MCA 2nd Semester**

Subject Code: **CS-5613**

Subject Name: **Computer Networks**

Aim of the Subject

Understand the fundamental concepts and basic principles of computer networks.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Familiarity with network terminologies, reference model, applications of network, design
- issues and the way computer network works.
- Problems associated with broadcast network and multiple access control protocols, knowledge of IEEE 802.3, 802.4 and 802.5, 802.11
- Design issues related to Network layer like routing, addressing and their protocols.
- Idea about client server architecture and working of DNS, HTTP and E Mail.
- Security issues in computer network and Introduction to Cryptographic algorithms and
- Digital Signature.

Unit 1

Introduction: Overview, Goal and Applications of Computer Networks; Network Classification - LAN, MAN, WAN, Internetworks and topologies; Network Software - Protocol hierarchies, Design issues for the layers, Connection Oriented and Connection less services, Service primitives, Relationship between Services and Protocols; Switching Techniques – Circuit Switching and Packet Switching; Reference models – OSI and TCP/IP, comparison and critique of OSI and TCP/IP reference models.

Physical layer: Guided Transmission Media- Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics; Wireless Transmission- Electromagnetic Spectrum, Radio Transmission, Microwave Transmission; digital modulation and multiplexing; The public switched telephone network - Structure of telephone network; The mobile telephone system - Generations of mobile phones.

Unit 2

Data Link Layer: Design issues – Services, Framing, Error Control and Flow Control; Error Detection Techniques - Parity Check and Cyclic Redundancy Check (CRC); Error Correction

Technique - Hamming code; Elementary Data Link Protocols - Unrestricted Simplex Protocol, Simplex Stop-and-Wait Protocol; Sliding Window Protocols - One-Bit Sliding Window Protocol, protocol using Go Back N and Selective Repeat; Data link layer in the Internet - PPP.

Unit 3

Medium Access Sublayer: Channel Allocation problem; Multiple access protocols- Pure Aloha, Slotted Aloha, CSMA Protocols, CSMA/CD, Collision-Free Protocols, wireless LAN protocols; IEEE MAC Sublayer protocols - Ethernet, Fast Ethernet, Gigabit Ethernet, wireless LANs and broadband wireless, Bluetooth; High speed LANs – Fast Ethernet, FDDI; Wireless LANs; Data Link Layer Switching – Bridges and Switches, their difference with Repeaters, Hubs, Routers and Gateways.

Unit 4

Network Layer: Design issues - Store-and-forward packet switching, services, implementation of connectionless and connection-oriented service, VC and datagram networks; Routing algorithms - Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, routing in Mobile hosts, routing in Ad Hoc networks; Congestion Control algorithms - General principle of Congestion control, leaky bucket algorithm, Token Bucket Algorithm; Internetworking - network difference, network connection, tunneling; The Network Layer in the Internet - Internet Protocol, Internet addressing and Internet Control protocols, ARP, DHCP and Mobile IP, Internet routing protocols - RIP, OSPF, BGP.

Unit 5

Transport Layer: Transport Services; Elements of transport protocols - Addressing, Connection establishment, Connection release, Error control and Flow control, Multiplexing; The Internet Transport Protocols - UDP and TCP, The TCP Service Model, The TCP Protocol.

Application layer: DNS, E-mail Protocols (SMTP, POP3, IMAP, MIME), WWW and HTTP, FTP, TELNET; Network Security - Cryptography, Symmetric Key Algorithms, Public key Algorithms and Digital Signatures.

Text Book(s)

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5th Edition,

Reference Material(s)

1.Pearson-Prentice Hall, 2011. 1. Behrouz A. Frouzan, Data Communications and Networking, McGraw-Hill Education, 5th Edition, 2013.

2. William Stallings, Data and Computer Communications, Pearson-Prentice Hall, 8 th Edition, 2007.

3. James F. Kurore & K

Course Name: **MCA 2nd Semester**

Subject Code: **CS-5617**

Subject Name: **Internet and Web Technology**

Aim of the Subject

To give students a good understanding of basic concepts of object-oriented program design with the help of real world problem solving using JAVA. Enable students to develop web applications through web technology and database collaboration, especially through JSP and Servlet.

Learning Outcomes

The students are expected to learn following after completion of the course:

- Practical exposure of object oriented program design using JAVA
- Conceptual clarity with hands on practice on advance issues related to classes and methods like visibility, scope,object reference and nested classes.
- implementation of reusability.
- Practical exposure on exceptions, I/O streams, collaboration, database handling inside web application.
- Exposure of concept and configuration of servers and web technology basics and their challenges.

Unit 1

Introduction to Java: Features of Java, Object-oriented Programming

Overview, Introduction of Java Technologies, JVM architecture and its

components, Java Program structure, Tokens, Control Constructs, Memory

concepts, Introduction to Class, Objects, Methods and Instance Variables, Naming Conventions, Constructors, Method Overloading, Static Method, Static

Field, Math Class, this reference, Garbage collection and finalize. String

Handling: The String Constructors, String Operations, Character Exaction,

String Comparison, String Buffer. Arrays: Creating an array, Enhanced

for Statement, Passing Multidimensional Arrays, Variable-Length Argument

lists, Using Command-line Arguments. Wrapper Class: Introduction to wrapper

classes. Inheritance: Relationship between Super classes and Subclasses, Using

super, Constructor in Subclasses, The Object Class, Object Copying in Java. Polymorphism: Method Overriding, Upcasting, Dynamic Method Dispatch, final Field, Method and classes, Abstract classes and Methods.

Unit 2

Packages and Interfaces: Defining a Package, Understanding CLASSPATH, Access Protection, Importing packages, Creating own Packages. Defining an Interface, Properties of Interface, Advantages of Interface Achieving Multiple Inheritance through Interfaces, Variables in Interfaces, Exception Handling: Introduction, keywords, Types of Exceptions, Java Exception Hierarchy, finally Block, Chained Exceptions, Declaring new Exception Types. Streams and Files: Introduction, Data Hierarchy, Files and Streams, Sequential-access Text Files, Object Serialization, Random-Access files, Java Stream Class Hierarchy. Applets: Applet Basics, Applet Architecture, Applet Life Cycle Methods, Applet HTML Tag and Attributes, Executing Applet in Web Browser and in Appletviewer.

Unit 3

Multithreading: Introduction, Java Thread Model, Thread priorities, Thread life cycle, Creating Thread, Thread Execution, Thread Synchronization, Inter-Thread Communication. Introduction To GUI: Introduction, Overview of swing Components, Introduction to Event Handling, Common GUI Event Type and Listener Interfaces, Adapter Classes, Layout Managers, Database connectivity through different databases.

Unit 4

Introduction to HTTP, web Server and application Servers, Installation of Application servers, Deployment Descriptors, The Generic Servlet, Lifecycle of Servlet. Servlet Packages, Classes, Interfaces and Methods, Handling Forms with Servlet. Session handling API, Servlet Collaboration, Attributes and various scopes of an Attribute

Unit 5

JSP Basics: JSP lifecycle, Directives, scripting elements, standard actions, implicit objects, Session handling in JSP, Separating Business Logic and Presentation Logic, Building and using JavaBean. MVC Architecture, Database operations handling in Web applications.

Text Book(s)

1. M. Hall, L. Brown, “Core Servlets and Java Server Pages”, 2nd edition, Pearson Education

2. Java 2: The Complete Reference by Herbert Schildt, Tata McGraw-Hill, 8th Edition, 2011.

Reference Material(s)

1. C. Bauer, G. King, “Hibernate in Action”, Manning Press

2. B. Basham, K. Sierra, B. Bates, “Head First Servlet and JSP”, 2nd Edition, O'Reilly Media.

3. The Java Programming Language, Ken Arnold , James Gosling , David Holmes.