

**PG DEPARTMENT OF COMPUTER SCIENCE**

**M.Sc. COMPUTER SCIENCE SYLLABUS**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**S.C.S. (A) College, Puri**



**Academic Session**

**2017-19**

**CBCS – M.Sc. Computer Science Syllabus**

Website: [www.scscollege.nic.in](http://www.scscollege.nic.in)

Year/ Semester	Subject	Paper	Title of the Paper	Credit	Max. Marks		
					IA	Uni. Exam	Total
<b>1<sup>st</sup> Year Semester – I</b>	Core	CS-1.1	Data Structure and Algorithms	4	30	70	100
	Core	CS-1.2	Computer System Architecture	4	30	70	100
	Core	CS-1.3	Database System & Implementation	4	30	70	100
	Core	CS-1.4	Object Oriented Design using UML	4	30	70	100
	Core Practical	CS-1.5	Algorithms Lab	4	-	100	100
<b>1<sup>st</sup> Year Semester – II</b>	Core	CS-2.1	Advance JAVA	4	30	70	100
	Core	CS-2.2	Theory of Computation	4	30	70	100
	Core	CS-2.3	Computer Network	4	30	70	100
	Core	CS-2.4	Software Engineering	4	30	70	100
	Core Practical	CS-2.5	JAVA Programming Lab	4	-	100	100
<b>2<sup>nd</sup> Year Semester – III</b>	Core	CS-3.1	Artificial Intelligence	4	30	70	100
	Core	CS-3.2	Operating System Design	4	30	70	100
	Core	CS-3.3	Compiler Design	4	30	70	100
	Core	CS-3.4	Mobile Computing	4	30	70	100
	Core Practical	CS-3.5	AI Programming Lab	4		100	100
<b>2<sup>nd</sup> Year Semester – IV</b>	Core	CS-4.1	Data Mining	4	30	70	100
	Core	CS-4.2	Cryptography and Network Security	4	30	70	100
	Core	CS-4.3	Internet Technology	4	30	70	100
	Core Practical	CS-4.4	Internet Technology Lab	4	-	100	100
		CS-4.5	Project Work and Viva Voice	4	-	100	100
			<b>Total</b>	<b>80</b>			<b>2000</b>

## SEMESTER – I

### CS - 1.1: DATA STRUCTURE & ALGORITHMS

- UNIT – I:** Introduction, The Role of Algorithms in Computing, Growth of Functions, Recurrences, Heapsort, Quicksort, Sorting in linear time.
- UNIT – II:** Elementary Data Structures, Hash Tables, Binary Search Trees, Red-Black trees, B-trees, Data Structures for Disjoint sets.
- UNIT – III:** Elementary Graph algorithms, Representation of Graph, BFS DFS and Topological Sort, Minimum Spanning Trees Shortest path (Single source and all-pairs), Maximum Flow.
- UNIT – IV:** Dynamic Programming (Matrix Chain, TSP Optimal Binary Search) Greedy algorithms, Amortized analysis, String Matching.
- UNIT – V:** P, NP and NP-Completeness, Approximate Algorithm, Computational Geometry.

**Text Books:**

- *T. H. Corman, C. E. Leiserson, R. L. Rivest and C. Stein:* Introduction to Algorithms.

**Reference Books:**

- *A. V. Aho, J. E. Hopcroft and J. D. Ullman:* The Design and Analysis of Computer Algorithms.

### CS – 1.2: COMPUTER SYSTEM ARCHITECTURE

- UNIT – I:** **Computer Function and Interconnection:** Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, PCI.  
**Cache Memory:** Computer Memory System, Cache Memory Principles, Elements of Cache Design, Pentium-4 Cache Organization.
- UNIT – II:** **External Memory:** Magnetic Disk, RAID, Optical Memory, Magnetic Tape, External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors, Fire Wire and InfiniBand.
- UNIT – III:** CPU Structure and Function: Processor Organization, Register Organisation, Instruction Cycle, Instruction Pipelining, The Pentium Processor.  
**Reduced Instruction Set Computer (RISC):** Instruction Execution Characteristics, Use of a Large Register File, Compiler-Based Register Optimization, Reduced Instruction Set Architecture, RISC Pipelining, MIPS R4000, SPARC, RISC Versus CISC Controversy.
- UNIT – IV:** Instruction-Level Parallelism and Superscalar Processors: Overview, Design Issues, Pentium-4.  
IA-64 Architecture: Motivation, General Organisation, Prediction, Speculation and Software Pipelining, IA-64 Instruction Set Architecture, Itanium Organization.

**UNIT – V: Parallel Organization:** Multiple Processor Organisation, Symmetric Multiprocessors, Cache Coherence and MESI Protocol, Clusters, Non-Uniform Memory Access (NUMA), Vector Computation.

**Text Books:**

- Stallings, W. Computer Organization and Architecture 4/ed. (PHI)

**Reference Books:**

1. Mano. M. M.: Computer System Architecture 3/ed. (PHI)
2. Hayes, J. P.: Computer Architecture and Organization 3/ed. (Mc. Graw-Hill Int.)
3. Quinn, M. J.: Parallel Programming in C with MPI and Open MP (TMH)

## CS – 1.3: DATABASE SYSTEMS & IMPLEMENTATION

### UNIT – I

**Database System:** Database System Applications, Database Systems versus File System, View of Data & Data Models, Database Languages, Database Users and Administrators. Transaction Management, Database System Structure, Application Architecture, Entity-Relationship Model: Basic Concepts & Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of E-R Database Schema, Reduction of an E-R Schema to Tables, Overview of Relational Model and Relational Database Design.

### UNIT – II

**SQL:** Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Views, Complex Queries, Modification of the Database, Joined Relations, Data-Definition Language, Embedded SQL, Dynamic SQL, Integrity and Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.

### UNIT – III:

**Query Processing:** Measures of Query cost. Selection Operation, Sorting, Join and other Operational, Evaluation of Expressions, Query Optimization: Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views.

### UNIT – IV:

**Object-Oriented Database:** Complex Data Types, Object-Oriented Data Model, Object-Oriented Language, Persistent Programming Languages, Persistent C++ Systems, Persistent JAVA Systems, Object-Relational Database: Nested Relations, Complex Types, Inheritance, Reference Types, Querying with Complex Types, Functions and Procedures, Object-Oriented Vs Object-Relational.

### UNIT – V

**Transactions:** Transaction, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolated, Transaction Definition in SQL, Testing for Serializability, Concurrency Control: Lock-Based, Timestamp-Based, Validation-Based Protocols Multiple Granularity, Multiversion Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Currency in Index Structures, Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent

Transactions, Buffer Management, Failure with Loss of Non-volatile Storage, Advance Recovery Techniques, Remote Backup Systems.

**Test Book:**

- Silberschatz. A., Korth. H. F. and Sudarshan. S.: Database System Concepts 4/ed. (Mc. Graw-Hill Int.)

## CS – 1.4: OBJECT ORIENTED DESIGN USING UML

### UNIT – I

**Complexity:** The inherent complexity of software - The Structure of complex systems - Bringing order to chaos - On designing complex systems. - Categories of analysis and design methods. The Object Model: The evolution of object model - Elements of object model - Applying the object model - Foundations of the object model. Classes and Objects: The nature of an object Relationship among objects - The nature of a class - Relationship among classes

### UNIT – II

**Structural Modelling:** Introduction to UML Software development life cycle - RUP- Inception Elaboration, Construction and Implementation - Classes - Relationships- Interfaces. Types and roles – Packages - Instances Class diagram - Object diagram.

### UNIT – III

**Behavioural Modelling:** Use cases - Use case diagram - Interaction diagram - Activity diagrams - Events and signals - State machines - Processes and Threads State chart Diagrams.

### UNIT – IV

**Architectural Modelling:** Components Component Diagram - Deployment - Deployment Diagrams - Patterns and Frameworks - Systems and Models.

### UNIT – V

Distributed objects communication between distributed objects - Distributed object model- Case Study: ATM. Library Information System, Payroll system, Student Information System, Railway Reservation System.

### Text Book(s)

1. Grady Booch, "Object - Oriented analysis and Design with Applications", Pearson Education.
2. Grady Hooch, James Rumbaugh and Ivar Jacobson. "The Unified Modeling Languages User Guide". Pearson Education.
3. Srinath. H Eriam, A Krishnamurthy Seitech "OOAD using UML"

### References

1. Ali Bahrami, "Object Oriented Systems Development" Irwin-McGraw Hill, New Delhi, International editions, 1999.
2. Martin Fowler, Kendall Scott, "UML Distilled-Applying the standard Object Modeling Language", Addison Wesley 1977.
3. UML in a Nut Shell by Alhir SPD Orilley

## CS – 2.1: ADVANCE JAVA

- UNIT – I:** Introduction to JAVA & its various features, JAVA Virtual Machine its architecture, Installation of JDK and ‘CLASSPATH’ setting, A First Java Program, Compilation and Applications, The JDK Directory Structure, Lexical issues of Java class, Object, Instance Data and Class Data, Methods, Constructions, Access Modifiers, Destroying Objects, inheritance, overriding, Dynamic method dispatch abstract class interface, Wrapper class boxing unboxing autoboxing and autounboxing, Package, multithreading, exception handling console and File I/O.
- UNIT – II:** GUI basic, Introduction to swing difference between AWT and swing, Swing components and containers Layout managers, event handling, Applets life cycle of applets steps for making applet, JLabel, JButton, JCheckBox, JRadioButton, JScrollPane, JTextField, JMenu, JTable, dialog boxes.
- UNIT – III:** JDBC Concept, The JDBC Connectivity Model, JDBC drivers, Database programming, connecting to Database, Working with database tables, SQL Warning Classes, Executing SQL Queries, ResultSet, Metadata, Prepared Statement, Parameterized Statements, Stored Procedures and Transaction Management, Networking, Basic of Networking, Inet Address, TCP/IP Sockets, Data Grams, Simple Client Server Socket Programming, Remote Method Invocation (RMI)
- UNIT – IV:** J2EE Overview, Client Tier, Middle Tier, Application Server Tier, The J2EE Platform, Servlet life cycle of Servlet steps for making servlet, deployment, Development descriptor and its configuration, Session tracking, The JSP Solution, JSP Syntax & Deployment, Variables and Expressions, Sessions in JSP page and taglib Directives.
- UNIT – V:** Enterprise Java Beans (EJB), EJB architecture, Classification of EJB, Session Beans, Stateless and Stateful Session Bean, Bean class, Developing and running bean application, MVC (Model View Control) architecture. JAR Concepts, Steps for creating simple jar files, creating executable JAR Files.

### Reference Books:

1. JAVA the Complete Reference, Herbert Schild, Tata McGraw-Hill.
2. JAVA Server Programming, Black Book Kogent, Dreamtech Publication.
3. Programming in JAVA, Sachin Malhotra & Saurabh Choudhury, Oxford Publication.
4. Introduction to JAVA Programming, Y. Daniel Liang Person Publication.

## CS - 2.2: THEORY OF COMPUTATION

### UNIT – I: Regular Languages & Finite Automata:

Deterministic Finite Automata, Non-deterministic Finite Automata, Equivalence of NFA, and DFA. Regular Expressions & Languages, Conversion of DFAs to Regular Expressions, and vice versa, Properties of Regular Languages: Pumping Lemma, Closure properties: Union, Intersection, Complement, Difference, Reversal, Homomorphism, and Inverse Homomorphism. Decision Problems for Regular Languages (Four Problems): The Emptiness/Universality Problem, The Finiteness Problem, The Membership Problem, And The Equivalence Problem, DFA Minimization.

**UNIT – II: Context Free languages & Pushdown Automata:**

Context Free Languages, Context Free Grammars, Derivation, Ambiguity, Parsing, Pushdown Automata: Definition of PDAs, Acceptance of PDAs by final state and by empty stack; Conversion of CFG to PDA and vice versa, DPDAs & DCFLs, Determinism & Parsing, Simplification of Chomsky Normal Form, Greibach Normal Form, The Pumping Lemma for CFL's. Closure properties: union, concatenation, \*, +, Homomorphisms, and Reversal, Nonclosure under reversal and complementation, Decision Problems for CFLs, CYK Algorithm, Undecidable Problems for CFLs.

**UNIT – III: Turing Machines:**

TM Definition and Notation; Instantaneous Descriptions, NTM & DTM, Programming tricks for TMs, Examples involving TM Computations, Extensions & Restrictions to Basic TM Model, (Multi Tape, Multi Dimensional, Counter machine, Two Stack PDAs). .

**UNIT – IV: Decidability Theory:**

The Church-Turing Thesis, Universal Turing Machines and TM Encoding, Decidable and semi-decidable languages, Recursive Enumeration and Decidability, Many-one Reductions, Hardness, Undecidability, Closure Properties. The Diagonalization Language, The Halting Problem, Post's Correspondence Problem, Undecidable Problems from Language Theory, Rice's Theorem, Linear Bounded Automata (LBA).

**UNIT – V: Complexity Theory:**

Measuring Complexity, The  $O$  (the big Oh),  $\Omega$  (Big Omega),  $\Theta$  (Theta) - Notations, Time Complexity classes: P, NP, NP-Completeness, Coping with NP-Completeness. Cook-Levin's Theorem, Some NP-Complete Problems: SAT, 3-SAT, Hamiltonian Path, Vertex Cover, Independent Set. Space Complexity classes: PSPACE, L, NL.

**Text:**

1. Introduction to Automata Theory, Languages & Computation - Hopcroft, Motwani & Ullman

**CS – 2.3: Computer Networks**

**UNIT – I:** Encoding & Modulation: Digital-to- Digital, Analog-to-Digital, Digital-to-Analog and Analog-to-Analog Conversions, Transmission of Digital Data, Interfaces and Modems: Digital Data Transmission, DTE-DCE Interface Standards, Modems, 56K Modem, Cable Modem Multiplexing: Frequency Division, Wave Division and Time Division Multiplexing, Multiplexing in the Telephone System, Digital Subscriber Line (DSL), FTTC.

**UNIT – II:** Data Link Control: Line Discipline, Flow Control, Error Control, Data Link Protocols: Asynchronous Protocols, Character-Oriented Protocols, Bit-Oriented Protocols, Link Access Procedures, Local Area Networks: Project 802, Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Token Ring, Fiber Distributed Data Interface (FDDI)

**UNIT – III:** Metropolitan Area Networks: IEEE 802.6 (DQDB), Switched, Multimegabit Data Services (SMDS). Switching: Circuit Switching, Packet Switching, Message Switching, Point-to-Point Protocol: Transition States, PPP Layers, Link Control Protocol (LCP), Authentication, Network Control Protocol (NCP)

**UNIT – IV:** Integrated Services, Digital Network: Services, Services Access to the ISDN, ISDN layers, Broad Band ISDN. X.25: X.25 Layers, Frame Relay: Frame Relay Operation, Frame Relay Layers, Congestion Control, Leaky Bucket Algorithm, Traffic Control.

**UNIT – V:** ATM: ATM Architecture, Switching, Switch Fabrics, ATM Layers, Service Classes, ATM Application, SONET: Synchronous Transport Signals, Physical Configuration, SONET Layers, SONET Frame, Multiplexing STS Frames, Applications, Networking & Internetworking Devices: Repeaters, Bridges, Routers, Gateways, Routing Algorithms (Distance Vector & Link State Routing).

**Text Books:**

1. Forouzan, B. A.: Data Communication and Networking, 2/Ed (TMH)

**Reference Books:**

1. Tanenbaum, A. S.: Computer Networks, 4/Ed (PHI)

## CS – 2.4: SOFTWARE ENGINEERING

**UNIT – I: Computer-Based System Engineering:** Emergent System Properties; Systems and their Environment, System Modelling, System Engineering Process, System Procurement. **Software Processes:** Software Process Models, Process Iteration, Software Specification, Design and Implementation, Software Validation and Evaluation, Automated Process Support. **Project Management:** Management Activities, Project Planning, Project Scheduling, Risk Management.

**UNIT – II: Software Requirements:** Functional and Non-Functional Requirements, User Requirements, System Requirements, Software Requirements, Document. **Requirements Engineering Processes:** Feasibility Studies, Requirements Elicitation and Analysis, Requirements Validation, Requirements Management. **System Models:** Context Models, Behavioural Models, Data Models, Object Models, CASE Workbenches.

**UNIT – III: Architectural Design:** System Structuring, Control Models, Modular Decomposition, Domain-Specific Architectures. **Distributed-System Architectures:** Multiprocessor Architectures, Client-Server Architectures, Distributed Object Architectures, CORBA. **Real-Time Software Design:** System Design, Real-Time Executives, Monitoring and Control Systems, Data Acquisition Systems. **Design with Reuse:** Component-Based Development, Application Families; Design Patterns.

**UNIT – IV: Dependability:** Critical Systems, Availability and Reliability, Safety, Security. **Critical Systems Specifications:** Software Reliability Specification, Safety Specification, Security Specification. **Critical Systems Development:** Fault Minimization, Fault Tolerance, Fault Tolerance Architectures, Safe System Design.



**UNIT – V: Verification and Validation:** Verification and Validation Planning, Software Inspections, Automated Static Analysis, Clean-room Software Development. **Software Testing:** Defect Testing, Integration Testing, Object-Oriented Testing, Testing Workbenches. **Software Cost Estimation:** Productivity, Estimation Techniques, Algorithmic Cost Modeling, Project Duration and Staffing.

**Text Book:**

1. Sommerville, I : Software Engineering, 6/c

**Reference Book:**

1. Pressman, R. S : Software Engineering, 4/e (McGraw Hill)
2. Aggarwal, K. K. & Singh, Y : Software Engineering (New Age International)

## **SEMESTER – III**

### **CS – 3.1: ARTIFICIAL INTELLIGENCE**

**UNIT – I:** Introduction to AI , History of AI , State of Art Intelligent Agents : Structure of Intelligent agent, Problem Solving by Searching: BFS, Uniform Cost Search, DFS, IDS, Bi-directional Search, Constraint Satisfactory Search, Informed Search Best First Search, Heuristic Function, Memory bounded search, A\* and IDA\*, Game Playing: Min-Max search and Alpha-Beta Pruning.

**UNIT – II:** Knowledge & Reasoning: Agents that reason logically, First Order Logic, Syntax and Semantics. Inference in First Order Logic: Inference Rules, Modus Ponens, Unification, Forward and Backward Reasoning, Resolutions Planning: A simple Planning Agent, from Problem Solving to Planning, Planning in Situation Calculus.

**UNIT – III:** Learning: Learning from Observations. A General Model of Learning Agents, Inductive Learning; Expert Systems, Architecture, Knowledge Acquisition, MYCIN; Natural Language Processing: Syntactic Processing, Semantic Analysis, Practical applications: Machine Translation, Efficient parsing.

**UNIT – IV:** Introduction to Pattern Recognition: Recognition & Classification Process, learning, Classification Patterns, Visual Image Understanding, Image Transformation; Perception: Image Formation, Image Processing Operations for easy Vision, Speech, Recognition, Introduction to Robotics.

**UNIT – V:** Prolog Programming: Basic Prolog Concepts, Facts, Rules, Structures, Lists, Executing and meaning of Prolog Programs, Recursive Programming, Backtracking with cuts. LISP programming.

**Text Book:**

1. V Stuart Russel &, Peter Norvig: Artificial Intelligence A Modern Approach (Person Education Asia)

## CS – 2.3: OPERATING SYSTEM DESIGN

**UNIT – I:** Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special Purpose Systems, Computing Environments, Open-Source Operating Systems. Operating System Services, User Operating System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating System Structure, Virtual Machines, Operating System Debugging, Operating System Generations, System Boot.

**UNIT – II:** Process: Process Concept, Process Scheduling, Operations on Processes, Inter-Process Communication, Examples of IPC Systems, Communication in Client-Server Systems. Multithreaded Programming: Multithreading Models, Thread Libraries, Threading Issues, Operating-System Examples.

**UNIT – III:** Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Process Scheduling. Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples, Atomic Transactions.

**UNIT – IV:** Deadlocks: System Model, Deadlock Characterization, Methods of Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, Recovery from Deadlock. Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium.

**UNIT – V:** Virtual-Memory Management: Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory. File System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection.

### Text Book:

1. Operating System Concepts: Silberschatz, Galvin, Gagne, 8/e (Wiley-India)

## CS – 3.3: COMPILER DESIGN

**UNIT – I:** Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling.,

**UNIT – II:** Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing.

**UNIT – III:** Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponc mode, Case study on Lex and Yacc.

**UNIT – IV:** Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking,.

**UNIT – V:** Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms.

**Test Books:**

1. Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman.

### **CS – 3.4: MOBILE COMPUTING**

**UNIT – I:** Personal Communications Services (PCS) Architecture, Cellular Telephony, Cordless Telephony and Low-Tier PCS, Third-Generation Wireless Systems. Wireless Transmission: Transmission concepts, Signal Propagation. Multiplexing Techniques: Space Division Multiplexing (SDM), Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division Multiplexing (CDM), Modulation, Spread spectrum techniques, Cellular System. Medium Access Control (MAC): Issues relating to MAC, SDMA, FDMA, TDMA, CDMA.

**UNIT – II:** Mobility Management: Handoff, Roaming Management for SS7 and CT2. Handoff Management: Mobility detection, Channel Assignment, Hard Handoff and Soft Handoff for Radio Link Transfer, Switching: Circuit Switched Data Services on Cellular Networks, Packet Switched Data Services on Cellular Networks, Addressing Mobile quality of Service, Access Point Control Protocol.

**UNIT – III:** Global System for Mobile Communication (GSM): GSM Architecture, Location Tracking and Call Setup, Data Services, Protocol Model, Mobility Management, Short Message Service (SMS), Roaming Facility and Security. Analog Mobile Phone Service (AMPS): IS-136 Mirth American TDMA Standard, IS-95: The North American CDMA Digital Cellular Standard.

General Packet Radio Service (GPRS): GPRS Architecture, GPRS Network, Interfaces and Procedures.

**UNIT – IV:** Third Generation Mobile Services (3G): IMT-2000, W-CDMA, CDMA-2000, Quality of Service (QoS) in 3G, Wireless Operating System for 3G Handset. Wireless LAN: Infrastructure and Ad hoc networks, IEEE 802.11; Hiperlan, Bluetooth. Mobile Multimedia (MM): Wireless ATM (WATM), WATM services, Reference model,

**UNIT – V:** Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol (DHCP), Ad hoc Networks. Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Security features. Wireless Application Protocol (WAP): WAP Model and Architecture, WAP Gateway, WAP Protocols, Wireless Markup Language (WML). Wireless Local Loop (WLL): WLL Architecture, WLL Technologies, and WLL Products.

**Text Books:**

1. Yi-Bing Lin and Imrich Chlamtac, “Wireless and Mobile Network Architectures”, 2001, John Wiley and Sons.
2. Jochen Schiller, “Mobile Communication”, 2000, Pearson Education Asia.

**Reference:**

1. Raj Pandya, “Mobile and Personal Communication Systems and Services”, 2001, Prentice Hall of India.
2. C.Y. William Lee, “Mobile Cellular Telecommunications: Analog and Digital System”, 2<sup>nd</sup> Edition, 1997, McGraw Hill.

## **SEMESTER – IV**

### **CS – 4.1: DATA MINING**

**UNIT – I:** Introduction: Definition of Data Mining – Data mining vs query tools – machine learning – Taxonomy of Data mining tasks – Steps in data mining process – overview of data mining techniques.

**UNIT – II:** Data Pre-Processing and Characterization: Data Integration and Transformation – Data Reduction – Discretization and Concept Hierarchy Generation – Primitives – Data Mining – Query Language – Generalization – Summarization – Analytical Characterization and Comparison.

**UNIT – III:** Association Rule – Mining: Market basket analysis, frequent Itemset generations, The Apriori Principle, Candidate Itemset generation and Pruning, Support counting using Hash Tree, Multi Dimensional Data from Transactional Database and Relational Database, FP-Growth Algorithm, Objective Measures of Interestingness.

**UNIT – IV:** Classification: Classification – Decision Tree Induction – Bayesian Classification – Back Propagation, Lazy Learners, nearest neighbour, Rule based classification, Accuracy, Prediction – Linear regression, Non-linear regression models.

**UNIT – V:** Cluster analysis: Types of Data, Distance measures, Evaluation criteria measures, Clustering Methods – Partitioning Methods, K-Means, Density

based Method – DBSCAN, Model based clustering methods – Expectation – Maximization outlier analysis.

**Text Books:**

1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufman Publisher, 2006.

**Reference Books:**

1. Usama M. Fayyad, Gregory Piatetsky Shapiro, Padhraj Smyth, Ramasamy Uthurusamy, Advances in Knowledge Discover and Data Mining, The M.I.T. Press, 2007.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit, John Wiley and Sons Inc., 2002
3. Alex Berson, Stephen Smith, Kurt Thearling, Building Data Mining Applications for CRM, Tata McGraw Hill, 2000
4. Margaret Dunham, Data Mining: Introductory and Advance Topics, Prentice Hall, 2002.
5. Daniel T. Larose John Wiley & Sons, Hoboken, Discovering Knowledge in Data: An Introduction to Data Mining, New Jersey, 2004
6. M. Panda, S. Dehuri and M. R. Patra, modern Approaches of Data Mining: Concepts and Techniques, Narosa Publication, 2016.

## **CS – 4.2: CRYPTOGRAPHY AND NETWORK SECURITY**

**UNIT – I:** Overview of cryptography, substitution and affine cipher and their cryptanalysis, Perfect Security, Block cipher, Data Encryption Standard(DES), Differential and linear Cryptanalysis, Block Cipher Design Principles, Block Cipher modes of operation, Advanced Encryption Standard.

**UNIT – II:** Principles of Public - key Cryptosystems, The RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Authentication Functions, Message Authentication Codes (MAC), Hash Functions, Security of Hash Functions and MAC, Secure Hash Algorithm, HMAC.

**UNIT – III:** Discrete Logarithms, ElGamal Cryptosystem, Algorithm for Discrete Logarithm Problem, security of ElGamal System, Schnorr signature scheme, The ElGamal signature scheme, The digital signature algorithm, Provable secure signature schemes.

**UNIT – IV:** Elliptic curve over the reals, Elliptic curves modulo a prime, Properties of Elliptic curves Point compression and ECies, Computing point multiples on Elliptic curves, Elliptic curve digital signature algorithm, Elliptic curve factorization, Elliptic curve primality test.

**UNIT – V:** Network Security Practice: Kerberos, X.509 Authentication Service, Public Key Infrastructure, E-Mail Security (Pretty Good Privacy), IP Security (Architecture, Authentication Header, Encapsulating Security Payload, Combining Security, Associations, Key Management), Web Security (Secure Sockets Layer and Transport Layer Security).

**Books Recommended:**

1. W. Stallings – “Cryptography and Network Security Principles” and Practice, Person Education Asia, 2000. (3<sup>rd</sup> Edition) Chapters: [1, 3, 5, 9, 10 (10.1, 10.2), II, 12(12.2, 12.4), 13(13.3), 14, 15, 16, 17].
2. D. Stinson Cryptography: Theory and Practice, CRC press, 2006. Chapters: [1, 2(2.3), 6, 7, 12].

**References:**

1. A. Menezes, P. Van Oorsch, S. Vanstans- Handbook of Applied Cryptography, CRC Press, 1997.
2. B. Schneier - Applied Cryptography, New York, Wiley, 1996.
3. N. Koblitz: A course in number theory and Cryptography, Springer Verlag.

### **CS – 4.3: INTERNET TECHNOLOGY**

**UNIT – I:** Introduction to Swing and JDBC, Advance GUI Programing Using swing, Containers, Components, Layout Managers, Event handling technique; JFrame, JPanel, JLabel, JButton, JCheck Box, JRadio Button, Jtext Field, JText Area , JScroll Pane, JTable , Networking and socket programming , JDBC API, steps of JDBC, RMI (Remote Method Invocation)

**UNIT – II:** Internet and Web Technology Internetworking concept, Internet backbones and its features, Internet Access - Dial up connection, Direct connection and Broadband connection, Role of ISP, Function of Hub, Switch, Bridge Router and Gateways in Internet, Internet Protocols - TCP/IP, FTP, HTTP, TELNET , Gopher and WAIS, Internet addressing - IP address, domain names, URLs, Distinction between Intranet and Extranet.

**UNIT – III:** Web Programming Over view of WWW, Web Browsers, Web servers, Basics of HTML, and XHTML programming - Syntax Document structures, images, hyperlinks, List, Tables, Forms, Frames, CSS, Basic JAVA Script programming loop, function and arrays XML document structure XML schema and parsing XML document

**UNIT – IV:** Enterprise JAVA: Overview JAVA-EE API ,Web applications , JAVA Servlet technology - Life Cycle of Servlet, Servlet API, Servlet packages, Types of servlet, Database Access, Stateles and Statefull Protocols, Session Tracking, JSP technology - Architecture and anatomy of JSP page, JSP life cycle, JSP with MVC architecture, Session tracking, JSF and AJAX

**UNIT – V:** EJB (Enterprise JAVA Beans) EJB Technology, EJB Component Architecture, Role of EJB and its life cycle, Types of beans, Stateless and Stateful beans, Context and Dependency injection for JAVA EE Platform, JAVA Persistence API,

**Recommended Books:**

1. Developing Web Application - Ralph Mosely, Willey New Delhi.
2. Internet working with TCP/IP, Volume 1 Douglas E. Comer.
3. JAVA Server Programming (JEE6) Black Book - Kogent S. Willey India (P) Ltd.

**References:**

1. HTML, XHTML, XML Complete Reference TATA McGraw Hill.
2. J2EE Complete Reference - JIM Keogh TATA McGraw Hill.
3. Java Programming's Advance topics 3rd edition Joe Wigglesworth, Paula Macmillan