

SYLLABUS
(Effective from academic session 2019-20)

FOR THE DEGREE

OF

Master of Computer Applications
Four-Semester Full Time Programme

SCHOOL OF BASIC SCIENCES



MANIPAL UNIVERSITY
JAIPUR

		15	5	6	23			15	3	6	21	
	Total Contact Hours (L + T + P)	26				Total Contact Hours (L + T + P)	24					
	THIRD SEMESTER					FOURTH SEMESTER						
II	CA 7101	Data Mining & Warehousing	3	1	0	4	CA 7270	Major Project	-	-	-	15
	CA 7102	Cloud Computing & Infrastructure Services	3	1	0	4						
	CA 7103	Compiler Design	3	1	0	4						
	CA 7140-2	Program Elective-II	3	0	0	3						
	CA 7143-5	Program Elective-III	3	0	0	3						
	CA 7130	Data Mining LAB	0	0	2	1						
	CA 7131	Minor Project	0	0	4	2						
			15	3	6	21						
	Total Contact Hours (L + T + P)	24				Total Contact Hours	15					

Programme Electives –I

CA 6240 DATA SCIENCE

CA 6241 SOFTWARE QUALITY ASSURANCE

CA 6242 BLOCKCHAIN & CRYPTOCURRENCY

Programme Electives –II

CA 7140 CRYPTOGRAPHY AND NETWORK SECURITY

CA 7141 DISTRIBUTED SYSTEMS

CA 7142 MOBILE COMPUTING

Programme Electives –III

CA 7143 AI & SOFT COMPUTING

CA 7144 UNIX & SHELL PROGRAMMING

CA 7145 MACHINE LEARNING

Master of Computer Applications

First Semester

MA 6117: DISCRETE MATHEMATICS [3 1 0 4]

Set Theory: sets, subsets, set operation, Cartesian product, relation (properties, equivalence relation, and partition) and function (different types of functions and composite function). Principal of inclusion and exclusions (statement only and simple problems), Generating Functions recurrence relation. Order relation and Structures: Partially order, algebraic structures and POSET, Lattices, distributive, and complemented lattices, Boolean Lattice, Uniqueness of Boolean Lattices Boolean expression & function. Semi group & Group: Binary operation, semi- groups, product and quotients, groups products and quotients, Bernside theorem (statement only and simple problems) coding & decoding. Mathematical Logic: Statement and notations, connectives, normal forms, well-formed formulas, implication, Tautology, Predicate calculus.

References:

1. C.L. Lui, *Elements of Discrete Mathematics*, (4e) Houghton Mifflin, 2017
2. J.P.Tremblay& R. Manohar, *Discrete Mathematical Structure with Applications to Computer Science*, (1e) McGraw Hill Education – 2017

CA 6101 WEB TECHNOLOGIES [3 1 0 4]

Introduction : Concept of WWW, Internet and WWW, HTTP Protocol : Request and response, Web browser and Web servers, Features of Web 2.0, Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation, JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons, XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT, PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP, PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs. Introduction to Angular JS4

References:

1. R. Moseley &M. T. Savaliya, *Developing Web Applications*, (2e) Wiley-India, 2013Team at Kogent Learning Solutions Inc., *Web Technologies, Black Book*, (1e) Dreamtech Press, 2009
2. Team at Kogent Learning Solutions Inc., *HTML 5, Black Book*, (2e) Dreamtech Press, 2011
3. J. Sklar, *Web Design Principles*,(5e)Cengage Learning, 2012
4. Harwani, *Developing Web Applications in PHP and AJAX*, (1e) McGrawHill, 2010
5. P.J. Deitel& H.M. Deitel, *Internet and World Wide Web How to program*, (4e) Pearson, 2007

CA 6102 SOFTWARE ENGINEERING & PROJECT MANAGEMENT [3 1 0 4]

Introduction to Software Engineering: Software Components, Software Characteristics, Software Crisis, Software Engineering Processes; Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Agile; Requirement Engineering Process: Analysis, Documentation, Review and Management of User Needs, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS; Basic Concept of Software Design, 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; Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering; The Management spectrum- (The people, the product, the process, the project), Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO) and its types, SEI capability maturity model, Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models. Basics of Project Management: Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles.

References:

1. R. S. Pressman, *Software Engineering: A Practitioners Approach*, (3e) McGraw Hill, 2009.
2. R. Mall, *Fundamentals of Software Engineering*, (4e) PHI Publication, 2014.
3. K. K. Aggarwal and Y. Singh, *Software Engineering*, (3e) New Age International Publishers, 2008.
4. P. Jalote, *Software Engineering*, Wiley, (1e) 2010.
5. Sommerville, *Software Engineering*, Addison Wesley, (10e) 2013.

CA 6103 FORMAL LANGUAGES AND AUTOMATA THEORY [3 1 0 4]

Mathematical Preliminaries and Notation: Three basic concepts, Some Applications, Deterministic Finite Accepters, Nondeterministic Finite Accepters, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata; Regular Expressions, Identifying Non-regular Languages; Context-Free grammars: Parsing and Ambiguity, Context-Free Grammars and Programming Languages, Methods for Transforming Grammars, Two important Normal Forms; Nondeterministic Pushdown Automata, Pushdown Automata and Context-Free Languages, Deterministic Pushdown Automata and Deterministic Context-Free Languages; The Standard Turing Machine: Linear Bounded Automata, Recursive and Recursively Enumerable Languages, Unrestricted Grammars, Context Sensitive grammars and Languages, The Chomsky Hierarchy.

References:

1. P. Linz, *An Introduction To Formal Languages and Automata*, (4e) Narosa Publishing House, 2006.
2. J. Martin, *Introduction to Languages and the Theory of Computation*, (3e) McGraw Hill, 2002.
3. J. Hopcroft, R. Motwani, *Introduction to Automata Theory, Languages and Computation*, (3e) Pearson Education, 2006.

CA 6104 OBJECT ORIENTED PROGRAMMING USING JAVA [3 1 0 4]

The History and Evolution of java: The Creation of Java, how java changed the internet, Java's Magic, Servlets, The java Buzzwords; An Overview of Java, arrays; **Introduction to classes:** Class fundamentals, declaring objects, Assigning Object reference variables, Introduction to methods,

Constructors, this keyword, Garbage collection, finalize() method, Overloading, objects as parameters, argument passing, returning objects, recursion, access control, final, nested and inner classes, string class; **I/O Basics:** Reading Console Input, Writing Console Output, Files, Applet fundamentals; **Inheritance:** basics, super, multilevel hierarchy, overriding, abstract classes, final with inheritance; **Packages and Interfaces:** Exception Handling, Multithreaded programming; String Handling, Applet Class, Event Handling; **Collections & Generics, Introduction to Swing:** Classes, component, Container, Panel, Window, frame, Canvas, working with frame, working with Graphics, using Swing Controls.

Reference

1. H. Schildt, *The Complete Reference Java Eight Edition*, (8e) Tata McGraw-Hill, reprint 2011.
2. S. Holzner, *Java 2 programming black book*, (5e) Dream Tech, New Delhi, reprint: 2005.

CA 6130 WEB TECHNOLOGY LAB [0 0 2 1]

Implement forms using HTML, Frames and CSS. Use of XML Tags, PHP : Use of basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP, PHP and MySQL : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

References:

1. R. Moseley & M. T. Savaliya, *Developing Web Applications*, (2e) Wiley-India, 2013
2. Team at Kogent Learning Solutions Inc., *Web Technologies, Black Book*, (1e) Dreamtech Press, 2009
3. Team at Kogent Learning Solutions Inc., *HTML 5, Black Book*, (2e) Dreamtech Press, 2011
4. J. Sklar, *Web Design Principles*, (5e) Cengage Learning, 2012
5. Harwani, *Developing Web Applications in PHP and AJAX*, (1e) McGrawHill, 2010
6. P.J. Deitel & H.M. Deitel, *Internet and World Wide Web How to program*, (4e) Pearson, 2007

CA 6131 SOFTWARE ENGINEERING AND PROJECT MANAGEMENT LAB [0 0 2 1]

Design Strategies, Unified Modeling Language (UML 2.0): Use case diagrams, Class diagram, Object diagram, Activity diagram, sequence diagram, component diagram, deployment diagram, state chart diagram, ER Diagrams and DFD Designing Test Cases, SQA plans.

References:

1. R. S. Pressman, *Software Engineering: A Practitioners Approach*, (3e) McGraw Hill, 2009.
2. R. Mall, *Fundamentals of Software Engineering*, (4e) PHI Publication, 2014.
3. K. K. Aggarwal and Y. Singh, *Software Engineering*, (3e) New Age International Publishers, 2008.
4. P. Jalote, *Software Engineering*, Wiley, (1e) 2010.
5. Sommerville, *Software Engineering*, Addison Wesley, (10e) 2013.

CA 6132 OBJECT ORIENTED PROGRAMMING USING JAVA LAB [0 0 2 1]

Control statements and arrays, Stacks and Lists, Strings, Classes and methods, Inheritance, Packages, Interfaces, Exception Handling, Threads, Input/Output, Network Programming, Event Handling, Applets, involving Swing, Programs involving Swing

References:

1. P.Radhak, *Object Oriented Programming Through Java*, (1e) Universities Press, 2006

2. H. Schildt, The Complete Reference Java Eight Edition, (8e) Tata McGraw-Hill, reprint 2011.
3. S. Holzner, Java 2 programming black book, (5e) Dream Tech, New Delhi, reprint: 2005.

Second Semester

MA 6206 GRAPH THEORY AND APPLICATIONS [3 0 0 3]

Graphs: Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler graphs, Hamiltonian paths and circuits, Trees, Properties of trees, Distance and centers in tree, Rooted and binary trees. **Trees, Connectivity & Planarity** Spanning trees, Fundamental circuits, Spanning trees in a weighted graph, cut sets, Properties of cut set, all cut sets, Fundamental circuits and cut sets, Connectivity and separability, Network flows: Isomorphism, Combinational and geometric graphs, Planer graphs, Different representation of a planer graph. **Matrices, Coloring and Directed Graph.** Chromatic number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four color problem, Directed graphs, Types of directed graphs, Digraphs and binary relations, Directed paths and connectedness, Euler graphs. **Permutations & Combinations:** Fundamental principles of counting, Permutations and combinations, Binomial theorem, combinations with repetition, Combinatorial numbers, Principle of inclusion and exclusion, Derangements, Arrangements with forbidden positions.

References:

1. N. Deo, *Graph Theory: With Application to Engineering and Computer Science*, (New Edition) Prentice Hall of India, 2003.
2. R.P. Grimald *Discrete and Combinatorial Mathematics: An Applied Introduction*, (5e) Addison Wesley, 2003.

CA 6201 RELATIONAL DATABASE MANAGEMENT DATABASE MANAGEMENT SYSTEMS [3 1 0 4]

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture; **Relational Algebra:** Fundamental Relational-Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Database; **SQL:** Data Definition Language, Data manipulation language, SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations, Authorization, Overview of the Design Process; **The Entity-Relationship Model:** Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features; **Normalization:** Anomalies, Referential integrity, 1NF, Functional Dependency, 2NF, 3NF, BCNF; **Hashing Techniques:** Dynamic Hashing; **Transactions:** Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Lock-Based Protocols, Log-Based Recovery, Recovery algorithms.

References:

1. S. Korth, *Database System Concept*, Mc-GrawHill, (6e), 2011.
2. R. Elmasri and S. Navathe, *Fundamentals of Database Systems*, (6e) Pearson Education, 2006.
3. T. Connolly, C. Begg, *Database Systems—A Practical Approach to Design, Implementation and Management*, (3e) Pearson Education, (2002).

CA 6202 DESIGN AND ANALYSIS ALGORITHMS [3 1 0 4]

Algorithm Analysis: A priori and a posteriori Analysis, Time Space Tradeoff, Asymptotic Notations, Properties of asymptotic notations, Recurrence equations, Solving recurrence equations using Substitution method and Master's method; **Trees:** B-Tree, Red Black Tree; **Divide and Conquer:** Binary

Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Matrix Multiplication; **Greedy Algorithms:** Knapsack Problem, Job Sequencing with deadline, Optimal Merge Pattern, Single Source Shortest Path, Minimum Cost Spanning tree; **Dynamic Programming:** Multistage Graphs, Matrix Chain Multiplication, All-Pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Travelling salesperson problem, Graph Traversals, Connected Components, Spanning Trees, Bi-connected components; **Complexity Classes:** Introduction to NP-Hard and NP-Completeness; **Approximation Algorithm, Randomized Algorithm.**

References:

1. E. Horowitz, S. Sahni and S. Rajasekaran, *Computer Algorithms*,(2e), University Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *Introduction to Algorithms*,(3e), MIT press, 2009.
3. Horowitz and Sahni, *Fundamental of Computer Algorithms*, (2e) Galgotia Publications, 2008

CA 6203 COMPUTER NETWORKS AND PROTOCOLS [3 1 0 4]

Network introduction: Classful addressing, other issues, Subnetting Classless addressing, variable length blocks, Subnetting, address allocation, Network Address Translation. Encapsulation, operation Data Link Layer: ARP package & RARP- Introduction, packet format Encapsulation, RARP server datagram , fragmentation , options, checksum, Network Layer: IP Package Types of messages, message format, error reporting, Query, Checksum, Debugging tools; Transport Layer: Process to process communication, User datagram, checksum, UDP operation UDP package Introduction, TCP services, TCP features, segment, TCP connection, State transition diagram, Flow control, Error control, Congestion control, TCP timers, options, TCP package; TCP Variants: SCTP services, SCTP features, packet format, association, state transition diagram, flow control, error control, congestion control, TCP RENO, Dynamic routing protocols : RIP,OSCF & BGP; Domain name Space (Application Layer): Name space, distribution of name space, DNS in the internet, resolution, DNS messages, controlling the server, out of band signaling, escape character. Transition from IPv4 to IPv6. Introduction to VLAN concept, Wireless Network protocols: WAP Architecture introduction. Introduction to MANET & VANET

References:

1. W. R Stevens, *TCP/IP Illustrated, Volume 1: The Protocols*,(2e) Addison-Wesley, 1994.
2. P. Loshin, *IPv6 Clearly Explained*, (4e) Morgan Kauffman, 2003.
3. C. E. Perkins, *Mobile IP Design Principles and Practices*, (1e) Addison-Wesley, 2008.
4. B. A. Forouzan, *TCP/IP Protocol Suite*, (2e) TMH, 2005.

CA 6230 Design and Analysis of Algorithms Lab [0 0 2 1]

Sorting & Searching Algorithm –insertion sort, selection sort, binary search. Basic data structures stacks and queues, graphs and trees, binary trees. Algorithmic paradigms - Recursion, divide-and-conquer – Merge sort, Quick sort, Greedy – Knapsack, Huffman encoding, Dynamic programming, lower bounds and optimal algorithms. Heaps - Heaps, priority queues, min-max heaps, heap sort. Dynamic search structures - Binary search trees, height balancing, B-trees, skip lists, hashing. Algorithms on arrays - Linear-time median finding, sorting in linear time (counting sort, radix sort, bucket sort), String matching (Rabin-Karp and Knuth-Morris-Pratt algorithms). Graph algorithms Traversal (BFS, DFS, topological sort), Minimum spanning trees (Prim and Kruskal algorithms), shortest paths (Dijkstra's and Floyd-Warshal algorithms); Mini-Projects & Case Studies.

References:

1. E. Horowitz, S. Sahni and S. Rajasekaran, *Computer Algorithms,(2e)*, University Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *Introduction to Algorithms,(3e)*, MIT press, 2009.
3. Horowitz & Sahni, *Fundamental of Computer Algorithms, (2e)* Galgotia Publications, 2003

CA 6231 RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB [0 0 2 1]

Experiments on DDL and Basic SQL, Advanced SQL, ER diagrams using DIA tool, Data Integrity Constraints and Built-in Functions, Design and Implementing the data requirements of a simple DB application, Experiments on Basic PL/SQL, PL/SQL Exceptions and Transactions, PL/SQL Cursors, PL/SQL Procedures, Functions and Packages, Project (DB application development with Java as front end).

References:

1. S. Korth, *Database System Concepts, (6e)* Mc-GrawHill, 2011.
2. R. Elmasri and S. Navathe, *Fundamentals of Database Systems, (6e)* Pearson Education, 2009.

CA 6232 COMPUTER NETWORKS AND PROTOCOLS LAB [0 0 2 1]

IPv4 addressing – Classful, CIDR, subnetting and Super netting, Switch and Router Introduction, Switch and Router's Components, Switch and Routers basic configuration commands, IOS User modes- User mode and Privileged mode, Dynamic configuration, Static and Dynamic Routing protocol, OSPF, VLAN, Network Address Translation. Flow control protocols, error detection and correction techniques, Bit stuffing and character stuffing. Implementation of link state routing protocol, distance vector routing protocol and other routing protocols. TCP and UDP socket programming.

References:

1. W. R Stevens, *TCP/IP Illustrated, Volume 1: The Protocols, (1e)* Addison-Wesley, 1994.
2. P. Loshin, *IPV6 Clearly Explained, (2e)* Morgan Kauffman, 2003.
3. C. E. Perkins, *Mobile IP Design Principles and Practices,(2e)* Addison-Wesley, 1998.
4. B. A. Forouzan, *TCP/IP Protocol Suite,(3e)*, TMH, 2005.

Program Elective-I**CA 6240 DATA SCIENCE [3 0 0 3]**

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. Data collection and management (ETL): Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources, Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Applications of Data Science: Technologies for visualization, Bokeh (Python) Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

References:

1. Cathy O'Neil and Rachel Schutt. *Doing Data Science, Straight Talk From The Frontline*, .O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. *Mining of Massive Datasets. v2.1*, Cambridge UniversityPress.

CA 6241 SOFTWARE QUALITY ASSURANCE [3 0 0 3]

Software Metrics : Definition , categories of Metrics , Token Count, Data Structure Metrics, Informational Flow Metrics, Object Oriented Metrics, Project Metrics, Metrics Analysis; Case Study on Metrics Software Reliability: Basic concept, Failures and Faults, Reliability Models- Basic Execution Time Model, Logarithmic Poisson Execution Time Model, Calendar Time component, The Jelinski-Moranda Model. Reliability Metrics, Case Study on Reliability; Software Quality - Quality attribute, Quality Criteria, Boehm Model, ISO 9126, Bug Seeding Model, Capability Maturity Model; Software Testing, Structural Testing, Top Down and Bottom up integration: System integration, Scenario Testing, Defect Bash, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing; Acceptance Testing, Regression testing, Regression test process, Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing; Ad hoc Testing; Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems, Case Study on software testing. Software Certification.

References:

1. S. Desikan, G. Ramesh, *Software Testing: Principles and Practices*,(2e) Pearson Education, 2007.
2. A. P. Mathur, *Fundamentals of Software Testing*,(2e) Pearson Education, 2008.
3. K. K. Aggarwal, Y. Singh, *Software Engineering*, (3e), New Age International Publication, 2008.
4. R. Mall, *Fundamentals of Software Engineering*, (3e) PHI, India 2009.

CA 6242 BLOCKCHAIN & CRYPTOCURRENCY [3 0 0 3]

Introduction: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof. Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain. Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin. Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market and Global Economy. Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

References:

1. Narayanan, J. Bonneau, E. Felten, A. Miller & S. Goldfeder, *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*,(1e) Princeton University Press, 2016.
2. Singhal & G. Dhameja *Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions*, (1e), Apress 2018.

3. Mohanty, *Blockchain - From Concept to Execution*, (2e) BPB Publications, 2018.

Third Semester

CA 7101 DATA MINING AND WAREHOUSING [3 1 0 4]

Introduction: Databases, Data Warehouses, Transactional databases, advanced database system and its applications, Data mining Functionalities: Concept/Class description, Association Analysis classification & Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

Data Warehouse and OLAP Technology for Data Mining: Differences between Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology.

Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Languages, and System Architectures, Concept Description: Characterization and Comparison, Analytical Characterization.

Mining Association Rules in Large Databases: Association Rule Mining, Market Basket Analysis, Basic Concepts, Mining Single-Dimensional Boolean Association Rules from Transactional Databases: the Apriori algorithm, Generating Association rules from frequent items, Improving the efficiency of Apriori, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint-Based Association Mining.

Classification & Prediction and Cluster Analysis: Issues regarding classification & prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Applications & Trends in Data Mining: Data Mining Applications, currently available tools.

References:

1. J. Han and M. Kamber, *Data Mining: Concepts and Techniques*, Morgan Kaufmann Pub.
2. Berson, Dataware housing, *Data Mining & DLAP*, @004, TMH.
3. W.H. Inmon "Building the Datawarehouse, 3ed, Wiley India.
4. Anahory, "Data Warehousing in Real World", Pearson Education.
5. Adriaans, "Data Mining", Pearson Education.
6. S.K. Pujari, "Data Mining Techniques", University Press, Hyderabad.

CA 7102 CLOUD COMPUTING & CLOUD INFRASTRUCTURE SERVICES [3 1 0 4]

Introduction to Clouds and Cloud Computing: Basic Concepts, Cloud Classifications, and Types of Services, deployment models; Classic Data Center (CDC): DBMS concepts, CDC drawbacks and need of Cloud Resources, CDC Management and case studies; Virtualized Data Center (VDC): Compute and Storage, Compute virtualization overview, Compute virtualization techniques, Virtual Machines, VM Resource management techniques, Physical to virtual conversion, Hypervisor Management Software, Virtual Infrastructure Requirements; Storage: Storage virtualization overview, Virtual Machine Storage, Block level and File level virtualization, Virtual provisioning and automated storage tiering; Networking: VDC networking overview, VDC networking components, VLAN and VSAN technologies, Network traffic management Desktop and Application: Desktop virtualization, Application virtualization, Business Continuity in VDC, Fault tolerance mechanism in VDC, Backup in VDC, Replication and migration in VDC, Cloud Security: Security basics, Cloud security concerns and threats, Cloud security mechanisms, Access control and identity management in Cloud

References:

1. Miller M, *Cloud Computing, 8th Edition*, Que Publishers 2008.
2. Buyya R K, *Cloud Computing: Principles and Paradigms*, Wiley Press, 2011.
3. K Saurabh, *Cloud Computing*, 2nd Edition, Wiley India
4. V Joysula, M Orr, G Page, *Cloud Computing: Automating the Virtualized Data Center*. Cisco Press, 2012.
5. Mei- Ling Liu, “*Distributed Computing: Principles and Application*”, Pearson Education, Inc. New Delhi. 2004.

CA 7103 COMPILER DESIGN [3 1 0 4]

Compiler Structure: Analysis-Synthesis model of compilation, various phases of a compiler, Tool based approach to compiler construction. A Simple One Pass Compiler: Overview, Syntax Definition, Syntax Directed Translation, Parsing, A Translator for simple expression. Lexical Analysis, Syntax Analysis, Syntax directed definitions: Inherited and Synthesized attributes, dependency graph, evaluation order, Bottom up and top down evaluation of attributes, L- and S- attributed definitions, Intermediate code generation, Intermediate representations, translation of declarations, assignments, control, Flow, Boolean expressions and procedure calls, Code generation and instruction selection: Issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, peep hole optimization.

References:

1. A.V. Aho, R. Sethi, J.D. Ullman. *Compilers: Principles, Techniques and Tools*, Addison – Wesley, 2006.
2. Appel. *Modern Compiler Implementation in C: Basic design*, Cambridge Press, 2004
3. Dhamdhare. *Compiler Construction*, McMillan India, 2004
4. Fraser and Hanson. *A Retargetable C Compiler: Design and Implementation*, Addison-Wesley, 2003

Program Elective-II

CA 7140 CRYPTOGRAPHY AND NETWORK SECURITY [3 0 0 3]

Elements of Number Theory : Euclid Algorithm, Prime Number Theorem, Euler’s, Fermat’s Little theorems, Entropy ; Classical Cipher Techniques: Caesar, Affine, Mono-alphabetic, Transposition, Polyalphabetic Ciphers; Security Attacks: Active V/S Passive, Security Services; Symmetric Encryption: Fiestel Cipher, Confusion and Diffusion, DES Algorithm; Asymmetric Encryption: Principles of Public Key Cryptosystems, RSA Algorithm; Message Authentication & Hashing; Digital Signatures: RSA Based, El-Gamal Signatures; Key distribution; User Authentication Protocols; E-Mail Security: PGP, S/MIME; IPsec: AH & ESP; SSL; TLS; Intrusion Detection: Statistical Anomaly Detection, Rule based detection, honeypots; Password Protection.

References:

1. S. Williams, *Cryptography and Network Security: Principles and Practices*,(6e) Pearson Education, 2013.
2. A. Kahate, *Cryptography and Network Security*, (4e) Tata Mc-Graw Hill, 2019
3. K. Charlie, *Network Security: Private Communication in a Public World*, (2e), Pearson Education, 2016.
4. V. Bagad, I. Dhotre, *Cryptography and Network Security*, (2e), Technical Publications, 2008.
5. B.A. Forouzan, *Network Security*, (3e), Tata Mc-Graw Hill, 2011.

CA 7141 DISTRIBUTED SYSTEMS [3 0 0 3]

Introduction: Distributed System, Goal of Distributed System, System Architecture, Distributed Computing Model, Advantages and Disadvantages, Design Issues. Distributed Shared Memory (DSM): Definition & Architecture, File Model and their Architecture, Access Model, File Applications. Inter Process Communications: Client Server Communication, RPC and their Architecture, Synchronization, Mutual Exclusion, Internet Protocol API. Distributed Scheduling: Issues and their Components, Types, Algorithm. Deadlock Distributed Scheduling: Issues in Deadlock Detection & Resolution, Deadlock Handling Strategy and Algorithm. Multimedia & Database: Multimedia Data, Quality of Service Managements, Types of Distributed Database and their Characteristics.

Text Book:

1. Jean Dollimore, Tim Kindberg, George Coulouris, *Distributed Systems: Concepts and Design*, 4th Edition, Addison Wesley, 2005.
2. A. Taunenbaum, *Distributed Systems: Principles and Paradigms*
3. G. Coulouris, J. Dollimore, and T. Kindberg, *Distributed Systems: Concepts and Design*, Pearson Education

References:

1. George Colouris, Jean Dollimore and Tim Kinder berg, *Distributed systems, concepts and design*, 3rd Edition.

CA 7142 MOBILE COMPUTING [3 0 0 3]

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

References:

1. J. Schiller, *Mobile Communications*, (2e), Addison Wesley, 2008.
2. A. Mehrotra, *GSM System Engineering*, (1e) 1997
3. M. V. D. Heijden, M. Taylor, *Understanding WAP*, (Har/Cdr edition), Artech House, 2000.
4. Charles Perkins, *Mobile IP*, (1e), Addison Wesley, 1997
5. Charles Perkins, *Ad hoc Networks*, (1e), Addison Wesley, 2001.

Program Elective-III

CA 7143 ARTIFICIAL INTELLIGENCE & SOFT COMPUTING [3 0 0 3]

General Issues and Overview of AI: The AI problems, what is an AI technique, Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input output and local variables, interaction and recursion, property lists and arrays.

Problem Solving, Search and Control Strategies: General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth first search. Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem reduction & AO* algorithm, constraint satisfaction problems.

Knowledge Representations: First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

Introduction to Soft Computing: Soft Computing concept explanation, brief description of separate theories.

References:

1. Elaine Rich and Kevin Knight "Artificial Intelligence". Tata McGraw Hill.
2. Munakata, T.: *Fundamentals of the New Artificial Intelligence*, Springer-Verlag New York, Inc., 1998. ISBN 0-387-98302-3
3. Cordon, O., Herrera, F., Hoffman, F., Magdalena, L.: *Genetic Fuzzy systems*, World Scientific Publishing Co. Pte. Ltd., 2001, ISBN 981-02-4016-3
4. Kecman, V.: *Learning and Soft Computing*, The MIT Press, 2001, ISBN 0-262-11255-8
5. Mehrotra, K., Mohan, C., K., Ranka, S.: *Elements of Artificial Neural Networks*, The MIT Press, 1997, ISBN 0-262-13328-8
6. Goldberg : *Introduction to Genetic Algorithms*

CA 7144 UNIX & SHELL PROGRAMMING [3 0 0 3]

Introduction: UNIX System Overview, Program and Processes, Error Handling, User Identification, Signals, System Calls and Library Functions.: File I/O: File Descriptors, Function for File Modification, I/O Efficiency, File Sharing, Atomic Operations.; Directories: Stat, Fstat, and Lstat Functions, File Types, Set-User-ID and Set-Group-ID, File Access Permissions , Function for modifying file permission and ownership, Symbolic Links, System Data Files and Information: Password File, Shadow Passwords and Other Data Files.; Process Environment: Process Termination, Memory Layout of a C Program, Memory Allocation, setjmp and longjmp Functions.; Process Control: fork Function, vfork Function, exit Functions, wait and waitpid Functions, Race Conditions, Changing User IDs and Group IDs.; Process Relationship: Logins, Process Groups, Sessions, Controlling Terminal, Job Control.; Signals: Signal Concepts, Functions to raise and handle Signals, Program Termination, abort and system functions.; Threads: Thread Concepts, Creation, Termination and Synchronization, Threads Control, Threads and Signals, Threads and fork, Threads and I/O.Shell programming:Basics of Shell Programming,UNIX shell commands, shell scripts variables, loops (for, while), and conditional statements (if else, case), Shell variables, arguments to shell procedure, test command, arithmetic with EXPR command, interactive shell procedures with read.

References:

1. W. R. Steven, S. A. Rago "Advanced Programming in the Unix environment", Addison Wesley, 2011
2. Y. P. Kanetkar "Unix Shell Programming". BPB Publication, 2009.

CA 1745 Machine Learning [3 0 0 3]

Machine Learning: Definition, Scope, Advantages of Machine Learning, Applications of Machine Learning, Tools of Machine Learning, Modeling, Testing and Training of Model, Statistical Techniques: Regression, Classification, Clustering, Probability Theories, Decision Trees, Categories of Machine Learning: Supervised Learning, Unsupervised, Reinforcement, Deep learning, Deep Reinforcement. k-Nearest Neighbors, Naive Bayes, Logistic Regression, Support Vector Machines, k-means clustering, Artificial Neural Network.

Textbook:

1. Oliver Theobald, *Machine Learning for Absolute Beginners: A Plain English Introduction*, Scatterplot Press, 2nd Edition, 2017

References:

1. Dhaval Maheta, *Machine Learning with R - Rattle Package*, LAP LAMBERT Academic Publishing, 2019.
2. Sebastian Raschka & Vahid Mirjalili, "*Python Machine Learning*", Ingram short title, 2nd Revised edition, 2017.

CA 7130 DATA MINING LAB [0 0 2 1]

Creation of table with the help of Data Mining Tool WEKA. Apply Pre-Processing techniques to the training data set of the table. Normalize table data using Knowledge Flow. Construction of Decision Tree for data and classify it. Writing of a procedure for Visualization for Table. Procedure for cross-validation using J48 Algorithm for weather table. Procedure for Clustering Weather data using EM Algorithm. Procedure for Clustering Customer data using Simple K- Means Algorithm.

Textbook:

1. Eibe Frank, Mark A. Hall, and Ian H. Witten, "*The WEKA Workbench*", Morgan Kaufmann, 2016

References:

1. Jiawei Han, Micheline Kamber and Jian Pei, "*Data Mining: Concepts and Techniques*", Morgan Kaufmann Publishers, July 2011.

CA 7131 MINOR PROJECT [0 0 4 2]

Content of Report Writing:

1. Cover page
2. Declaration
3. Acknowledgement
4. Abstract
5. Table of Content
6. Introduction
7. Survey of Technology
8. Requirement Analysis
 - 8.1. Problem Definition

- 8.2. Drawback of existing system
- 8.3. Requirement Specification
- 8.4. Feasibility Study
- 9. Planning and Scheduling
- 10. System Design
 - 10.1. Data Flow Diagram
 - 10.2. ER Diagram
 - 10.3. Data Dictionary and Data Model
 - 10.4. Schema Design
- 11. Coding Section
- 12. Screenshots of project
- 13. Testing
- 14. Limitation and Future Scope

Fourth Semester

CA 7270 MAJOR PROJECT [15]

Each student shall carry out a major project in the sixth semester. The project will be carried out under the supervision of a teacher of the department. When the project is carried out in an external organization (academic institution/ industry), a supervisor will also be appointed from the external organization. The project work will be evaluated jointly by the internal supervisor and an examiner to be appointed by the department in consultation with the internal supervisor. The major project shall carry 100 marks distributed as follows: Dissertation: 50% weightage Viva-voce: 50% weightage.

Project Report Formulation:

1. Original copy of the Approved Proforma and Project Proposal
2. Bio-data of the guide with her/his signature and date
3. Certificate of Originality
4. Project documentation
 - a) Cover page
 - b) Declaration
 - c) Acknowledgement
 - d) Abstract
 - e) Table of Content
 - f) Introduction
 - g) Survey of Technology
 - h) Requirement Analysis
 - 8.1. Problem Definition
 - 8.2. Drawback of existing system
 - 8.3. Requirement Specification
 - 8.4. Feasibility Study
 - i) Planning and Scheduling
 - j) System Design
 - 10.1. Data Flow Diagram
 - 10.2. ER Diagram
 - 10.3. Data Dictionary and Data Model
 - 10.4. Schema Design
 - k) Coding Section

- l) Screenshots of project
 - m) Testing
 - n) Limitation and Future Scope
5. A CD consisting of the executable file(s) of the complete project should be attached on the last page of the project report. In no case, it should be sent separately.