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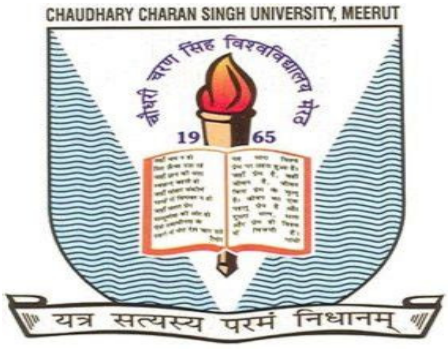

EVALUATION SCHEME &SYLLABUS
First Year
FOR

MASTER OF COMPUTER APPLICATION
(MCA)
(Two Years Course)

As per
AICTE MODEL CURRICULUM
(Effective from the Session: 2020-21)

MCA (MASTER OF COMPUTER APPLICATION)

MCA FIRST YEAR, 2020-21

SEMESTER-I

S.No.	Subject Code	Subject Name	Hours			Sessional Marks			External Marks	Total Marks	Credit
			L	T	P	CT	TA	Total			
1.	**MCA- 111**	Fundamental of Computers & Emerging Technologies	4	0	0	18	12	**30**	**70**	**100**	4
2.	**MCA- 112**	Problem Solving using C	3	1	0	18	12	**30**	**70**	**100**	4
3.	**MCA- 113**	Principles of Management & Communication	4	0	0	18	12	**30**	**70**	**100**	4
4.	**MCA- 114**	Discrete Mathematics	4	0	0	18	12	**30**	**70**	**100**	4
5.	**MCA- 115**	Computer Organization & Architecture	3	1	0	18	12	**30**	**70**	**100**	4
6.	**MCA- 151**	Problem Solving using C **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
7.	**MCA- 152**	Office Automation **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
8.	**MCA- 153**	Professional Communication **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
		Total						**300**	**500**	**800**	**26**

CT: Class Test **TA**:TeacherAssessment**L/T/P:** Lecture/ Tutorial/Practical

SEMESTER-II

S. No.	Subject Code	Subject Name	Hours			Sessional Marks			External Marks	Total Marks	Credit
			L	T	P	CT	TA	Total			
1.	**MCA-211**	Theory of Automata & Formal Languages	4	0	0	18	12	**30**	**70**	**100**	4
2.	**MCA- 212**	Object Oriented Programming	3	1	0	18	12	**30**	**70**	**100**	4
3.	**MCA- 213**	Operating Systems	4	0	0	18	12	**30**	**70**	**100**	4
4.	**MCA- 214**	Database Management Systems	4	0	0	18	12	**30**	**70**	**100**	4
5.	**MCA- 215**	Data Structures & Analysis of Algorithms	3	1	0	18	12	**30**	**70**	**100**	4
6.	**MCA – 216**	Cyber Security* **(Qualifying Course)**	2	0	0	18	12	***30**	***70**	***100**	0
7.	**MCA- 251**	Object Oriented Programming **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
8.	**MCA- 252**	DBMS **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
9.	**MCA- 253**	Data Structures & Analysis of Algorithms **Lab**	0	0	4	30	20	**50**	**50**	**100**	2
		Total						**300**	**500**	**800**	**26**

CT: Class Test **TA**:TeacherAssessment **L/T/P**: Lecture/ Tutorial/Practical

*** Qualifying Non-credit Course**

Syllabus

MCA 1st Year
Semester – Ist

MCA (MASTER OF COMPUTER APPLICATION) FIRST YEAR
SYLLABUS
SEMESTER-I

Program Outcome (PO) - MCA

- Apply knowledge of Computing fundamentals, Computing specialization, Mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements for employability.
- Identify, formulate, research literature, and solve complex Computing problems reaching substantiated conclusions using fundamental principles of Mathematics, Computing sciences, and relevant domain disciplines for advance higher studies. .
- Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
- Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
- Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice for enhancing skills.
- Recognize the need, and have the ability, to engage in independent learning for continual development as a Computing professional .
- Demonstrate knowledge and understanding of computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
- Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
- Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
- Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Specific Programme Outcomes (SPO) - MCA

- To prepare graduates who will create systems through software development to solve problems in Industry domain areas.
- To Prepare Graduates who will contribute to societal growth through research in their chosen field.
- To prepare graduates who will perform both as an individual and in a team through good analytical, design and implementation skills.
- To prepare graduates who will be lifelong learners through continuous professional development.

Recognize the importance of ethical practices with new technologies

MCA – 111 : FUNDAMENTAL OF COMPUTERS & EMERGING TECHNOLOGIESL

Course Outcomes

1. Discuss the impact of disruptive technologies on project design, implementation, and transformation.
2. Identify major areas where technologies can be applied and their implications for organizational change.
3. Recognize current and emerging disruptive technologies and their potential to impact social conditions, the economy, and daily life.
4. Design a project plan that incorporates a new and emerging technology and illustrates its impact on organizations and industries.
5. Review current literature on the selection, implementation, and evaluation of new and emerging technologies and their impacts.
6. Conduct and present a project on a technologies analysis that incorporates audio, video, and images.
7. Compare and contrast current and emerging technologies and their implications for social ethics and the global workplace.
8. Appreciate the unique characteristics of and differences between disruptive technologies and their impacts.

-T-P : 4-0-0 External Max. Marks: 70

Unit	Topic	Proposed Lecture
I	**Introduction to Computer:** Definition, Computer Hardware & Computer Software **Components:** Hardware – Introduction, Input devices, Output devices, Central ProcessingUnit,Memory-PrimaryandSecondary.Software-Introduction,Types – System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler **Problem solving concept:** Algorithms – Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.	**08**
II	**Operating system:** Definition, Functions, Types, Classification, Elements of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Data communication, topologies.	**08**

III	**Internet :** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	**08**
IV	**Block chain:** Introduction, overview, features, limitations and application areas fundamentals of Block Chain. **Crypto currencies:** Introduction , Applications and use cases **Cloud Computing:** It nature and benefits, AWS, Google, Microsoft & IBM Services	**08**
V	**Emerging Technologies:** Introduction, overview, features, limitations and application areas of Augmented Reality , Virtual Reality, Grid computing,Green computing, Big data analytics, Quantum Computing and BrainComputer Interface	**08**

Suggested Readings:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall ofIndia, 6th Edition Dec 2014.
2. Norton P., "Introduction to Computers", McGraw HillEducation, 7th Edition July 2017
3. Goel A., "Computer Fundamentals",Pearson, Nov 2017
4. BalagurusamyE.," FundamentalsofComputers",McGrawHill, second reprint 2010
5. TharejaR., "FundamentalsofComputers",OxfordUniversityPress 2016

MCA - 112 :PROBLEM SOLVING USING C

Course Outcomes

1. To learn the basics of different types of programming
2. To understand the syntax and building blocks of the C- program.
3. To learn to solve a problem using the CProgram.
4. To compile and debug a C- Program.
5. To generate an executable file from program.

L-T-P :3-1-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Basics of programming:** Approaches to problem solving, Use of high level programming language for systematic development of programs, Concept of algorithm andflowchart, Concept and role of structured programming. **Basics of C**: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input/Output, Operators and expressions.	**08**

II	**Conditional Program Execution:** if, if-else, and nested if-else statements, Switch statements, Restrictions on switch values, Use of break and default with switch, Comparison of switch andif-else. **Loops and Iteration:** for, while and do-while loops, Multiple loop variables, Nested loops, Assignment operators, break and continue statement. **Functions:** Introduction, Types, Declaration of a Function, Function calls, Defining functions, Function Prototypes, Passing arguments to a function Return values and their types, Writing multifunctionprogram, Calling function by value, Recursive functions.	**08**
III	**Arrays:** Array notation and representation, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensional arrays. **Pointers:** Introduction, Characteristics, * and & operators, Pointer type declaration andassignment, Pointer arithmetic, Call by reference, Passing pointers tofunctions, arrayof pointers, Pointers to functions, Pointer to pointer, Array ofpointers. **Strings:** Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions.	**08**
IV	**Structure:** Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types **Storage classes**: Introduction, Types- automatic, register, static and external.	**08**
V	**Dynamic Memory Allocation**: Introduction, Library functions – malloc, calloc, realloc andfree. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files. **Graphics:** Introduction, Constant, Data types and global variables used in graphics, Library functions used indrawing, Drawing andfilling images, GUI interaction within the program.	**08**

Suggested Readings:

1. Kanetkar Y., "Let Us C", BPBPublications. Revised and Updated 2017 edition.
2. HanlyJ. R. and Koffman E. B.,"Problem Solving and Program Design in C", Pearson Education. 5th *Edition*, 2008
3. SchildtH., "C- The Complete Reference",McGraw-Hill. 4th *Edition* (December 10, 2002)
4. Goyal K. K. and Pandey H.M., Trouble Free C", University SciencePress, 2017
5. Gottfried B., "Schaum's Outlines- Programming in C", McGraw-HillPublications.
6. Kochan S.G., "Programming in C",Addison-Wesley. 4th *Edition,* 2015
7. Dey P. and Ghosh M., "Computer Fundamentals and Programming in C", Oxford UniversityPress. Second Edition, July 2013

MCA - 113 : PRINCIPLES OF MANAGEMENT & COMMUNICATION

Course Outcomes

1. Exhibit adequate verbal and non-verbal communication skills .
2. Demonstrate effective discussion, presentation and writing skills.
3. Increase confidence in their ability to read, comprehend, organize, and retain written information. Improve reading fluency.
4. Write coherent speech outlines that demonstrate their ability to use organizational formats with a specific purpose; Deliver effective
5. speeches that are consistent with and appropriate for the audience and purpose.
6. Develop proper listening skills; articulate and enunciate words and sentences clearly and efficiently.
7. Show confidence and clarity in public speaking projects; be schooled in preparation and research skills for oral presentations.

L-T-P : 4-0-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Management**: Need, Scope, Meaning and Definition. The process of Management, Development of Management thought F.W. Taylor and Henry Fayol, Horothorne Studies, Qualities of an Efficient Management.	**08**
II	**Planning &Organising:** Need, Scope and Importance of Planning, Steps in planning, Decision making model. Organising need and Importance, Organisational Design, Organisational structure, centralisation and Decentralisation, Deligation.	**08**
III	**Directing & Controlling:** Motivation—Meaning, Importance, need.Theoriesof Motivation,Leadership—meaning,needandimportance,leadershipstyle,Qualitiesof effective leader, principles of directing, Basic control process, Different control Techniques.	**08**
IV	**IntroductiontoCommunication:**WhatisCommunication,Levelsofcommunication, Barriers to communication, Process of Communication, Non-verbal Communication, TheflowofCommunication:Downward,Upward,LateralorHorizontal(Peergroup) Communication, Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance ofTechnical communication.	**08**
V	**Business letters:** Sales & Credit letters; Claim and Adjustment Letters; Job application andResumes. **Reports:** Types; Structure, Style & Writing of Reports. **Technical Proposal:** Parts; Types; Writing of Proposal; Significance. NuancesofDelivery;BodyLanguage;DimensionsofSpeech:Syllable;Accent;Pitch; Rhythm; Intonation; Paralinguistic features ofvoice; Communication skills, Presentation strategies, Group Discussion; Interview skills; Workshop; Conference; Seminars.	**08**

Suggested Readings:

1. P.C.Tripathi,P.N.Reddy,"PrinciplesofManagement",McGrawHillEducation6th Edition 2017.
2. C.B.Gupta,"ManagementPrinciplesandPractice",SultanChand&Sons3rd edition 2012.
3. T.N.Chhabra, "Business Communication", Sun IndiaPublication.
4. V.N.AroraandLaxmiChandra,"ImproveYourWriting",OxfordUniv.Press,2001,NewDelhi.
5. Madhu Rani and SeemaVerma, "Technical Communication: A Practical Approach", Acme Learning, NewDelhi-2011.
6. MeenakshiRaman&SangeetaSharma,"TechnicalCommunication-PrinciplesandPractices",Oxford Univ. Press, 2007, NewDelhi.
7. KoontzHarold&WeihrichHeinz,"EssentialsofManagement",McGrawHill5th Edition2008.
8. RobbinsandCoulter,"Management",PrenticeHallof India,8th Edition (January 14, 2004).
9. James A. F., Stoner, "Management", Pearson EducationDelhi. Seventh *Edition*, 2009.
10. P.D.Chaturvedi, "Business Communication", PearsonEducation.2011

MCA - 114 : DISCRETE MATHEMATICS

Course Outcomes

1. Be familiar with constructing proofs.
2. Be familiar with elementary formal logic.
3. Be familiar with set algebra.
4. Be familiar with combinatorial analysis.
5. Be familiar with recurrence relations.
6. Be familiar with graphs and trees, relations and functions, and finite automata.

L-T-P : 4-0-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**SetTheory:**Introduction,SizeofsetsandCardinals,Venndiagrams,Combinationof sets, Multisets, Ordered pairs and SetIdentities. **Relation:**Definition,Operationsonrelations,Compositerelations,Propertiesof relations,Equalityofrelations,Partialorderrelation. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions.	**08**
II	**Posets,HasseDiagramandLattices:**Introduction,Partialorderedsets,Combination ofPartialorderedsets,Hassediagram,Introductionoflattices,Propertiesoflattices– Bounded, Complemented, Modular and Completelattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	**08**
III	**Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.	**08**
IV	**Algebraic Structures:**Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	**08**

V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero Base cases. **Recurrence Relation & Generating functions:** Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences. **Combinatorics:** Introduction, Counting techniques and Pigeonhole principle, Polya's Counting theorem.	**08**

Suggested Readings:

1. KennethH.Rosen,"DiscreteMathematicsandItsApplications",McGrawHill,2006.
2. B.Kolman,R.CBusbyandS.CRoss,"DiscreteMathematicsStructures",PrenticeHall,2004.
3. R.PGirimaldi,"DiscreteandCombinatorialMathematics",AddisonWesley,2004.
4. Y.N.Singh,"DiscreteMathematicalStructures",Wiley-India,Firstedition,2010.
5. SwapankumarSarkar,"ATextbookofDiscreteMathematics",S.Chand&CompanyPVT.LTD.V.
6. Krishnamurthy,"CombinatoricsTheory&Application",East-WestPressPvt.Ltd.,NewDelhi.
7. Liptschutz, Seymour, "Discrete Mathematics", McGrawHill.
8. J.P.Trembely&R.Manohar,"DiscreteMathematicalStructurewithapplicationtoComputerScience", McGrawHill.

MCA - 115 : COMPUTER ORGANIZATION & ARCHITECTURE

Course Outcomes

1. Understand the theory and architecture of central processing unit.
2. Analyze some of the design issues in terms of speed, technology, cost, performance.
3. Design a simple CPU with applying the theory concepts.
4. Use appropriate tools to design verify and test the CPU architecture.
5. Learn the concepts of parallel processing, pipelining and interprocessor communication.
6. Understand the architecture and functionality of central processing unit.
7. Exemplify in a better way the I/O and memory organization.
8. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

L-T-P : 3-1-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction:** Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. **Processor organization:** general registers organization, stack organization and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro-program sequencing, concept of horizontal and vertical microprogramming.	**08**

IV	**Memory:**Basicconceptandhierarchy,semiconductorRAMmemories,2D&21/2D memoryorganization.ROMmemories.Cachememories:conceptanddesignissues& performance, address mapping andreplacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Suggested Readings:

9. KennethH.Rosen,"DiscreteMathematicsandItsApplications",McGrawHill,2006.
10. B.Kolman,R.CBusbyandS.CRoss,"DiscreteMathematicsStructures",PrenticeHall,2004.
11. R.PGirimaldi,"DiscreteandCombinatorialMathematics",AddisonWesley,2004.
12. Y.N.Singh,"DiscreteMathematicalStructures",Wiley-India,Firstedition,2010.
13. SwapankumarSarkar,"ATextbookofDiscreteMathematics",S.Chand&CompanyPVT.LTD.5 edition 2009.
14. Krishnamurthy,"CombinatoricsTheory&Application",East-WestPressPvt.Ltd.,NewDelhi.
15. Liptschutz, Seymour, "Discrete Mathematics", McGrawHill. Thirdedition,2009
16. J.P.Trembely&R.Manohar,"DiscreteMathematicalStructurewithapplicationtoComputerScience" , McGrawHill. 30th Reprint (2007)

MCA - 151: PROBLEM SOLVING USING C LAB

L-T-P :0-0-4 External Max. Marks : 50

Course Outcomes

1. Use the fundamentals ofC programming in trivial problem solving
2. Enhance skill on problem solving by constructing algorithms
3. Identify solution to a problem and apply control structures and user
4. defined functions for solving the problem
5. Demonstrate the use of Strings and string handling functions
6. Apply skill of identifying appropriate programming constructs for problem solving

1. Program to implement conditional statements in Clanguage.
2. Program to implement switch-case statement in Clanguage
3. Program to implement looping constructs inClanguage.
4. Program to perform basic input-output operations in Clanguage.
5. Program to implement user defined functions in Clanguage.
6. Program to implement recursive functions in Clanguage.
7. Program to implement one-dimensional arrays in C language.
8. Program to implement two-dimensional arrays in C language.
9. Program to perform various operations on two-dimensional arrays in Clanguage.
10. Program to implement multi-dimensional arrays in Clanguage.
11. Program to implement string manipulation functions in Clanguage.
12. Program to implement structure in Clanguage.
13. Program to implement union in Clanguage.
14. Program to perform file handling operations in Clanguage.
15. Program to perform graphical operations in Clanguage.

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

MCA - 152: Office Automation LAB

Course Outcomes

1. To familiarize the students in preparation of documents and presentations with office automation tools
2. To write research report
3. To install softwares such as MS Office, Python
4. to perform documentation including tables, charts, reports
5. to perform presentation skills for business presentations

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

1. Basic operating system windows working environment. Working on various office advance component available in MS-Office/ Open-Office for Documents, Excel and Power point (Minimum Ten Labs).
2. Introduction to HTML Language and its basic tags to make static pages as form, table, and simple text data formatted (Minimum Two Labs).
3. Install and configure Python on system and know how to execute basic programs for condition and loop structures (Minimum Two Labs).
4. Write a Report with standard format and styles using MS-Office/ Open-Office (Minimum Two Labs).
5. Write a Research paper with standard format and styles using MS-Office/ Open-Office. (Minimum Two Labs).

6. Prepare Make a Mark-Sheet/ Balance-Sheet in excel with all formatting and styles (Minimum One Lab).
7. Prepare a presentation in Power Point on any one topic from current semester subjects (Minimum One Lab).

MCA - 153 : PROFESSIONAL COMMUNICATION LAB

L-T-P : 0-0-4 External Max. Marks : 50

Course Outcomes

1. To provide an overview of Prerequisites to Business Communication.
2. To put in use the basic mechanics of Grammar.
3. To provide an outline to effective Organizational Communication.
4. To underline the nuances of Business communication.
5. To impart the correct practices of the strategies of Effective Business writing.

1. Group Discussion: participating in group discussions- understanding group dynamics.
2. GD strategies-activities to improve GD skills. Practical based on Accurate and Current GrammaticalPatterns.
3. Interview Etiquette-dress code, body language attending job interview – Telephone/Skype interview one to one interview &Panelinterview.
4. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/ Kinesics, practicing word stress, rhythm in sentences, weak forms, intonation.
5. Oral Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics voice modulation ,Audience Awareness, Presentation plan visualaids.
6. Speaking:-Fluency & Accuracy in speech- positive thinking, Improving Self expression Developing persuasive speaking skills, pronunciation practice (for accept neutralization) particularly of problem sounds, in isolated words as well as sentences.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress andIntonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio-VisualUsage.

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

MCA 1st Year
Semester - IInd

MCA (MASTER OF COMPUTER APPLICATION) FIRST YEAR

SYLLABUS

SEMESTER-II

MCA - 211: THEORY OF AUTOMATA & FORMAL LANGUAGES

Course Outcomes

1. To provide a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical (abstract) view towards algorithmic design and in general computation itself.
2. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part as well.
3. Become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area

L-T-P : 4-0-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Basic Concepts and Automata Theory:** Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-NerodeTheorem, Simulation of DFA and NFA.	**08**
II	**Regular Expressions and Languages:**RegularExpressions,TransitionGraph,Kleen'sTheorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	**08**
III	**Regular and Non-Regular Grammars**: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form(GNF),Chomsky Hierarchy, Programming problems based on the properties of CFGs.	**08**
IV	**Push Down Automata and Properties of Context Free Languages**: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL),	**08**

	Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	
V	**Turing Machines and Recursive Function Theory** : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem,Post Correspondence Problem, Introduction to Recursive FunctionTheory.	**08**

Suggested Readings:

1. J.E. Hopcraft, R. Motwani, and Ullman, "Introduction to Automata theory, Languages and Computation", Pearson EducationAsia,3rd Edition, 2006.
2. J. Martin, "Introduction to languages and the theory of computation", McGraw Hill, 4thEdition 2010.
3. C. Papadimitrou and C. L. Lewis, "Elements and Theory of Computation",PHI.
4. K.L.P. Mishra and N. Chandrasekaran ,"TheoryofComputer Science Automata Languages and Computation" , PHI. 3rd Edition, 2006

MCA - 212 : OBJECT ORIENTED PROGRAMMING

Course Outcomes

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
3. Understand object, garbage collection, classes and interfaces.
4. Understand the principles of inheritance, packages and interfaces.
5. Demonstrate the concepts of polymorphism and inheritance Demonstrate
6. GUI applications, AWT and events.

L-T-P : 3-1-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction:** Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Source File Structure, and Compilation. Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifies, static members, Comments, Data Types, Variables, Operators, Control Flow, Arrays.	**08**

II	**Inheritance, Interfaces, and Packages:** Inheritance: Super classes, sub classes, Protected members, constructors in sub classes, Object class, abstract classes and methods.Interfaces:defininganinterface,implementinginterface,differencesbetween classes and interfaces and extending interfaces, Object cloning, inner classes. Packages: Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import Naming Convention ForPackages, Networking java.net package.	**08**
III	**Exception Handling, I/O**: Exceptions: exception hierarchy, throwing and catching exceptions,built-inexceptions,creatingownexceptions,StackTraceElements.Input/ Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and WritingFiles.	**08**
IV	**Multithreading and Generic Programming:** Differences between multi-threading andmultitasking,threadlifecycle,creatingthreads,synchronizingthreads,Inter-thread communication, daemon threads, thread groups. Generic Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.	**08**
V	**EventDrivenProgramming:**Graphicsprogramming:Frame,Components,working with 2D shapes,Using colors, fonts, and images. Basics of event handling: event handlers,adapterclasses,actions,mouseevents,AWTeventhierarchy.Introductionto Swing: layout management, Swing Components: Text Fields, Text Areas, Buttons, Check Boxes, Radio Buttons, Lists, choices, Scrollbars, Windows Menus andDialog Boxes.	**08**

Suggested Readings:

1. HerbertSchildt,"JavaThecompletereference|",McGrawHillEducation,8thEdition,2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", Prentice Hall, 9th Edition, 2013.
3. Steven Holzner, “Java Black Book”,Dreamtech.2005
4. BalagurusamyE,“ProgramminginJava”,McGrawHill*4th Edition* 2009
5. Naughton,Schildt,“TheCompletereferencejava2”,McGrawHill Seventh *Edition*, 2007

MCA - 213 : OPERATING SYSTEMS

Course Outcomes

1. Explain main components, services, types and structure of Operating Systems.
2. Apply the various algorithms and techniques to handle the various concurrency control issues.
3. Compare and apply various CPU scheduling algorithms for process execution.
4. Identify occurrence of deadlock and describe ways to handle it.
5. Explain and apply various memory, I/O and disk management techniques.

L-T-P : 4-0-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction**: Operating System Structure- Layered structure, System Components, Operating system functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multi processSystems, Multithreaded Systems, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	**08**
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation, Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem, Inter Process Communication models andSchemes, Process generation.	**08**
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance anddetection, Recovery from deadlock.	**08**
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms,Thrashing, Cache memory organization, Locality of reference.	**08**
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization andaccess mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	**08**

Suggested Readings:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts",WileyPublication. Seventh *Edition 2004*
2. SibsankarHalder and Alex A Arvind, "Operating Systems", PearsonEducation. 2nd *Edition2014*
3. Harvey M Dietel, "An Introduction to Operating System", PearsonEducation.
4. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, PearsonEducation 2010.
5. Harris, Schaum's Outline Of Operating Systems, McGrawHill First *Edition 2001*

MCA - 214 : DATABASE MANAGEMENT SYSTEMS

Course Outcomes

1. Defines the basics of the relational data model.
2. Lists the database design process steps.
3. Will be able to design and implement properly structured databases that match the standards based under realistic constraints and conditions.
4. Develops an Entity-Relationship model based on user requirements.

L-T-P : 4-0-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction:**Overview,DatabaseSystemvsFileSystem,DatabaseSystemConcept andArchitecture,DataModelSchemaandInstances,DataIndependenceandDatabase Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of SuperKey, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	**08**
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. IntroductiontoSQL:CharacteristicsofSQL,AdvantageofSQL.SQLDataTypeand Literals.TypesofSQLCommands.SQLOperatorsandtheirProcedure.Tables,Views andIndexes.QueriesandSubQueries.AggregateFunctions.Insert,UpdateandDelete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Proceduresin SQL/PL SQL	**08**
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	**08**
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	**08**
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	**08**

Suggested Readings:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGrawHill. Seventh Edition 2019
2. Date C J, "An Introduction to Database Systems", AddisionWesley. 3rd *Edition2018*
3. Elmasri,Navathe,"FundamentalsofDatabaseSystems",AddisionWesley. 7th *Edition2016*
4. O'Neil, "Databases", ElsevierPub. 1st *Edition2016*
5. Ramakrishnan, "Database Management Systems", McGrawHill. 3rd *Edition2002*
6. Leon &Leon,"Database Management Systems", Vikas PublishingHouse.
7. BipinC.Desai,"AnIntroductiontoDatabaseSystems",GagotiaPublications. 4th *Edition*, 2005

MCA - 215: DATA STRUCTURES & ANALYSIS OF ALGORITHMS

Course Outcomes

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
5. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
6. Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.

L-T-P :3-1-0 External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type , Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations. **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	**08**

II	**Stacks**: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion-Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and PriorityQueue. **Searching:** Concept of Searching, Sequential search, Index Sequential Search,BinarySearch.ConceptofHashing&Collisionresolution Techniques used in Hashing.	**08**
III	**Sorting:** Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort. **Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	**08**
IV	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree.	**08**
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijikstra Algorithm, Bellman Ford Algorithm, All- pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequence Greedy Programming: Prims and Kruskal algorithm.	**08**

Suggested Readings:

1. Cormen T. H., Leiserson C. E., RivestR. L., and Stein C.,"Introduction to Algorithms", PHI. 3rd edition
2. Horowitz Ellis, SahniSartaj and Rajasekharan S., "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
3. DaveP.H.,H.B.Dave,"DesignandAnalysisofAlgorithms",2ndEdition,PearsonEducation 2013.
4. Lipschuts S., "Theory and Problems of Data Structures", Schaum'sSeries. 2nd *Edition*
5. GoyalK. K., Sharma Sandeep& Gupta Atul, "Data Structures and Analysis of Algorithms", HP Hamilton.
6. Lipschutz,DataStructuresWithC-SIE-SOS,McGrawHill 3rd edition
7. SamantaD.,"ClassicDataStructures",2ndEditionPrenticeHallIndia.
8. Goodrich M. T. and Tomassia R., "Algorithm Design: Foundations, Analysis and Internet examples", John Wiley andsons.
9. Sridhar S., "Design and Analysis of Algorithms", Oxford Univ.Press. 3rd edition 2014
10. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", PearsonEducation. 3rd *Edition*
11. R. Neapolitan and K. Naimipour, "Foundations of Algorithms",4th edition, Jones an Bartlett Studentedition.
12. ReemaThareja, Data Structures using C, Oxford Univ.Press 2nd edition 2014

MCA - 216 : CYBER SECURITY

Course Outcomes

1. Follow a structured model in Security Systems Development Life Cycle (SDLC)
2. Detect attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources
3. Protect data and respond to threats that occur over the Internet
4. Design and implement risk analysis, security policies, and damage assessment
5. Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment
6. Provide contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security

L-T-P :2-0-0 **(Qualifying Course)** External Max. Marks : 70

Unit	Topic	Proposed Lecture
I	**Introduction-** Introduction to Information Systems, Types of Information Systems, Development of Information Systems, Introduction to Information Security and CIA triad, Need for Information Security, Threats to Information Systems, Information Assurance and Security RiskAnalysis, Cyber Security.	**08**
II	**Application Security-** (Database, E-mail and Internet), Data Security Considerations-(Backups, Archival Storage and Disposal of Data), Security Technology-(Firewall , VPNs, Intrusion Detection System), Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack.	**08**
III	Introduction to E-Commerce , Threats to E-Commerce, Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Cryptography Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets - Access Control, CCTV,Backup Security Measures.	**08**
IV	**Security Policies**- Why policies should be developed, Policy Review Process, Publication and Notification Requirement of policies, Types of policies – WWW policies, Email Security policies, Corporate Policies, Sample SecurityPolicies. **Case Study –** Corporate Security	**08**

V	**Information Security Standards-**ISO, IT Act, Copyright Act, IPR. Cyber Crimes , Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law, Copy Right Law , Semiconductor Law and Patent Law , Software Piracy and Software License.	**08**

MCA – 251 : OBJECT ORIENTED PROGRAMMING LAB

L-T-P :0-0-4 External Max. Marks : 50

Course Outcomes

1. The students, after the completion of the course, are expected to
2. Develop and implement Java programs for simple applications that make use of classes
3. Develop and implement Java programs with arraylist
4. Develop and implement Java programs for simple applications that make use of classes
5. Be able to design and analyze the time and space efficiency of the data structure

1. Use Java compiler and eclipse platform to write and execute javaprogram.
2. Creating simple javaprograms,
3. Understand OOP concepts and basics of Javaprogramming.
4. Create Java programs using inheritance andpolymorphism.
5. Implement error-handling techniques using exception handling andmultithreading.
6. Understand the use of javapackages.
7. File handling and establishment of databaseconnection.
8. Develop a calculator application injava.
9. Develop a Client ServerApplication.
10. Develop GUI applications using Swingcomponents.

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

MCA - 252: DATABASE MANAGEMENT SYSTEMS LAB

L-T-P :0-0-4 External Max. Marks : 50

Course Outcomes

1. Implement Basic DDL, DML and DCL commands
2. Understand Data selection and operators used in queries and restrict data retrieval and control the display order
3. Write sub queries and understand their purpose
4. Use Aggregate and group functions to summarize data
5. Join multiple tables using different types of joins
6. Understand the PL/SQL architecture and write PL/SQL
7. code for procedures, triggers, cursors, exception handling etc.
8. Use typical data definitions and manipulation commands.
9. Design applications to test Nested and Join Queries.
10. Implement simple applications that use Views.
11. Implement applications that require a Front-end Tool.
12. Critically analyze the use of Tables, Views, Functions and Procedures**.**

1. Installing oracle/MYSQL.
2. Creating Entity-Relationship Diagram using casetools.
3. Writing SQL statements Using ORACLE/MYSQL:
   a.Writing basic SQL SELECT statements.
   b.Restricting and sorting data.
   c.Displaying data from multiple tables.
   d.Aggregating data using group function.
   e.Manipulatingdata.
   f. Creating and managing tables.
4. Normalization.
5. Creatingcursor.
6. Creating procedure andfunctions.
7. Creating packages andtriggers.
8. Design and implementation of payroll processing system.
9. Design and implementation of Library Information System.
10. Design and implementation of Student Information System.
11. Automatic Backup of Files and Recovery ofFiles.

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

MCA – 253: DATA STRUCTURES & ANALYSIS OF ALGORITHMS LAB

L-T-P :0-0-4 External Max. Marks : 50

Course Outcomes

1. Be capable to identity the appropriate data structure for given problem
2. Have practical knowledge on the applications of data structures
3. Write functions to implement linear and non-linear data structure operations
4. Apply stack, Queues, Link List, Searching and Sorting techniques
5. Design algorithms using divide and conquer, greedy and dynamic programming.
6. Execute sorting algorithms such as sorting, graph related and combinatorial algorithm in a high level language.
7. Analyze the performance of merge sort and quick sort algorithms using divide and conquer technique.
8. Apply the dynamic programming technique to solve real world problems such as knapsack and TSP.

Program in C or C++ for following:

1. To implement addition and multiplication of two 2Darrays.
2. To transpose a 2Darray.
3. To implement stack usingarray
4. To implement queue usingarray.
5. To implement circular queue usingarray.
6. To implement stack using linkedlist.
7. To implement queue using linkedlist.
8. To implement BFS using linkedlist.
9. To implement DFS using linkedlist.
10. To implement LinearSearch.
11. 11.To implement BinarySearch.
12. To implement BubbleSorting.
13. To implement SelectionSorting.
14. To implement InsertionSorting.
15. To implement MergeSorting.
16. To implement HeapSorting.
17. To implement Matrix Multiplication by strassen'salgorithm
18. Find Minimum Spanning Tree using Kruskal'sAlgorithm

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

EVALUATION SCHEME & SYLLABUS

FOR

MASTER OF COMPUTER APPLICATION (MCA)

(Two Years Course)

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

MCA SECOND YEAR, 2021-22

SEMESTER-III

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	MCA 311 N	Artificial Intelligence	4	0	0	18	12	30	70	100	4
2.	MCA 312 N	Software Engineering	4	0	0	18	12	30	70	100	4
3.	MCA 313 N	Computer Network	4	0	0	18	12	30	70	100	4
4.	MCA 314 N	Cloud Computing	4	0	0	18	12	30	70	100	4
5.	MCA 315 N	Big Data	4	0	0	18	12	30	70	100	4
6.	MCA 351 N	Artificial Intelligence Lab	0	0	3	30	20	50	50	100	2
7.	MCA 352 N	Software Engineering Lab	0	0	3	30	20	50	50	100	2
8.	MCA 353 N	Mini Project**	0	0	4	30	20	50	50	100	2
		Total								**800**	**26**

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

SEMESTER-IV

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	MCA 411 N	Elective – 3 Privacy & Security in Online Social Media	4	0	0	18	12	30	70	100	4
2.	MCA 412 N	Elective – 4 Big Data	4	0	0	18	12	30	70	100	4
3.	MCA 413 N	Elective – 5 Mobile Computing	4	0	0	18	12	30	70	100	4
4.	MCA 451 N	Project	-	-	-	-	200	200	300	500	14
		Total								**800**	**26**

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

** The Mini Project (6 weeks) conducted during summer break after II semester and will be assessed during III semester. The Course will be carried out at the Institute under the guidance of a Faculty Members.

Elective-1 MCA 314 N		Cryptography & Network Security
		Data Warehousing & Data Mining
		Software Project Management
		Cloud Computing
		Compiler Design

Elective-2 MCA 315 N		Web Technology
		Big Data
		Simulation & Modeling
		Software Testing & Quality Assurance
		Digital Image Processing

Elective-3 MCA 411 N		Privacy & Security in Online Social Media
		Soft Computing
		Pattern Recognition
		Data Analytics
		Software Quality Engineering

Elective-4 MCA 412 N		Blockchain Architecture
		Neural Network
		Internet of Things
		Modern Application Development
		Distributed Database Systems

Elective-5 MCA 413 N		Mobile Computing
		Computer Graphics and Animation
		Natural Language Processing
		Machine Learning
		Quantum Computing

SECOND YEAR SYLLABUS
SEMESTER-III

MCA-311N : Artificial Intelligence		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Define the meaning of intelligence and study various intelligent agents.	
CO 2	Understand, analyze and apply AI searching algorithms in different problem domains.	
CO 3	Study and analyze various models for knowledge representation.	
CO 4	Understand the basic concepts of machine learning to analyze and implement widely used learning methods and algorithms.	
CO 5	Understand the concept of pattern recognition and evaluate various classification and clustering techniques	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Artificial Intelligence:** Introduction to artificial intelligence, Historical development and foundation areas of artificial intelligence, Tasks and application areas of artificial intelligence. Introduction, types and structure of intelligent agents, Computer Vision, Natural language processing.	**08**
II	**Searching Techniques:** Introduction, Problem solving by searching, Searching for solutions, Uniformed searching techniques, Informed searching techniques, Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning.	**08**
III	**Knowledge Representation and Reasoning:** Propositional logic, Predicate logic, First order logic, Inference in first order logic, Clause form conversion, Resolution. Chaining- concept, forward chaining and backward chaining, Utility theory and Probabilistic reasoning, Hidden Markov model, Bayesian networks.	**08**
IV	**Machine Learning:** Introduction, types and application areas, Decision trees, Statistical learning methods, Learning with complete data - concept and Naïve Bayes models, Learning with hidden data- concept and EM algorithm, Reinforcement learning.	**08**
V	**Pattern Recognition:** Introduction and design principles, Statistical pattern recognition, Parameter estimation methods - Principle component analysis and Linear discrimination analysis, Classification techniques - Nearest neighbor rule and Bayes classifier, K-means clustering, Support vector machine.	**08**

Suggested Readings:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education.
2. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
3. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education.
4. Patterson D. W., "Artificial Intelligence and Expert Systems", Prentice Hall of India Publications.
5. Khemani D., "A First Course in Artificial Intelligence", McGraw Hill.
6. Winston P. H., "Artificial Intelligence", Pearson Education.
7. Thornton C. and Boulay B.," Artificial Intelligence- Strategies, Applications and Models through Search", New Age International Publishers.

MCA-312 N: Software Engineering		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Explain various software characteristics and analyze different software Development Models.	
CO 2	Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards.	
CO 3	Compare and contrast various methods for software design.	
CO 4	Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing.	
CO 5	Manage software development process independently as well as in teams and make use of various software management tools for development, maintenance and analysis.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	**08**
II	**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	**08**
III	**Software Design:** 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. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	**08**
IV	**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top Down and Bottom- Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through,	**08**

	Code Inspection, Compliance with Design and Coding Standards.	
V	**Software Maintenance and Software Project Management:** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	**08**

Suggested Readings:

1. R S Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill.
2. Pankaj Jalote, "Software Engineering", Wiley
3. Rajib Mall, "Fundamentals of Software Engineering", PHI Publication.
4. K K Aggarwal and Yogesh Singh, "Software Engineering", New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, "Fundamentals of Software Engineering", PHI Publication.
6. Ian Sommerville, "Software Engineering", Addison Wesley.
7. Kassem Saleh, "Software Engineering", Cengage Learning
8. Pfleeger, "Software Engineering", Macmillan Publication

MCA-313 N: Computer Networks		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.	
CO 2	Apply knowledge of error detection, correction and learn concepts of flow control along with error control.	
CO 3	Classify various IP addressing techniques, subnetting along with network routing protocols and algorithms.	
CO 4	Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.	
CO 5	Understand applications-layer protocols and elementary standards of cryptography and network security.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Data Communications**: Introduction: Data communication Components and characteristics, Data representation and Data flow. **Networks:** LAN, WAN, MAN, Topologies. **Protocols and Standards**: ISO-OSI model and TCP-IP Model. **Network Connecting Devices:** HUB, Bridge, Switch, Router and Gateways. **Transmission Media:** Guided and unguided Media **Classification and Arrangement:** Wired LANs and Wireless LANs	**08**
II	**Data Link Layer:** **Error Detection and Error Correction:** Types of errors, LRC, VRC, Checksum, CRC, and Hamming Code. **Flow Control and Error Control:** Stop and Wait Protocol, Sliding Window, Go-back-N-ARQ Protocol and Selective-Repeat ARQ Protocol. **Channel Allocation Protocols:** Random Access, Controlled and Channelization techniques such as ALOHA, CSMA, CSMA/CD, CDMA/CA, TDMA, FDMA, Token Passing, etc.	**08**
III	**Network Layer:** **Switching Techniques:** Circuit Switching, Packet Switching, and Message Switching. **Logical addressing:** IPv4 and IPv6 Address schemes, Classes and subnetting **Network Layer Protocols:** ARP, RARP, BOOTP and DHCP **Routing Techniques:** Interdomain and Intradomain routing with examples.	**08**
IV	**Transport Layer:** **Introduction to Transport Layer**: Process-to-Process Delivery:	**08**

	Reliable and unreliable Connection, Port and Socket Addressing **Transport Layer Protocols with packet formats:** User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). **Congestion Control:** Techniques for handling the Congestion Control. **Quality of Service (QoS):** Flow Characteristics and techniques to improve QoS.	
V	**Application Layer:** **Basic Concept of Application Layer:** Domain Name System, World Wide Web, Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login. **Introduction to Cryptography:** Definition, Goal, Applications, Attacks, Encryption, decryption, public-key and private key cryptography.	**08**

Suggested Readings:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.
4. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
5. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
6. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.
7. D. Comer, "Computer Networks and Internets", Pearson.
8. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

(Elective-1) MCA – 314 N: Cloud Computing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.	
CO 2	Develop the ability to understand and use the architecture to compute and storage cloud, service and models.	
CO 3	Understand the application in cloud computing.	
CO 4	Learn the key and enabling technologies that help in the development of cloud.	
CO 5	Explain the core issues of cloud computing such as resource management and security.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing- issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.	08
II	**Cloud Services:** Types of Cloud services: Software as a Service- Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	**Collaborating Using Cloud Services:** Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	**Virtualization for Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.	08
V	**Security, Standards and Applications:** Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	08

Suggested Readings:

1. David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing : A Practical Approach", Tata McGraw-Hill 2010.
4. Haley Beard, "Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.
5. G. J. Popek, R.P. Goldberg, "Formal requirements for virtualizable third generation Architectures, Communications of the ACM", No.7 Vol.17, July 1974

(Elective-2) MCA – 315N: Big Data		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO1	Demonstrate knowledge of Big Data Analytics concepts and its applications in business.	
CO2	Demonstrate functions and components of Map Reduce Framework and HDFS.	
CO3	Develop queries in NoSQL environment.	
CO4	Explain process of developing Map Reduce based distributed processing applications.	
CO5	Explain process of developing applications using HBASE, Hive, Pig etc.	
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	**08**
II	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. **Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	**08**

III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	**08**
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **NoSQL** Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections **Spark**: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN **SCALA:** Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	**08**
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **Hive** - Apache Hive architecture and installation, Hive shell, Hive services, Hive	**08**
	metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.	

Suggested Readings:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. Big-Data Black Book, DT Editorial Services, Wiley.
3. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill.
4. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
5. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons
6. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT
7. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP
8. Tom White, "Hadoop: The Definitive Guide", O'Reilly.
9. Eric Sammer, "Hadoop Operations", O'Reilly.
10. Chuck Lam, "Hadoop in Action", MANNING Publishers
11. Deepak Vohra, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools", Apress
12. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly
13. Lars George, "HBase: The Definitive Guide", O'Reilly.
14. Alan Gates, "Programming Pig", O'Reilly.
15. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
16. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons.
17. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons
18. Pete Warden, "Big Data Glossary", O'Reilly

MCA-351N: Artificial Intelligence Lab

Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study and understand AI tools such as Python / MATLAB.	
CO 2	Apply AI tools to analyze and solve common AI problems.	
CO 3	Implement and compare various AI searching algorithms.	
CO 4	Implement various machine learning algorithms.	
CO 5	Implement various classification and clustering techniques.	

DETAILED SYLLABUS

1. Installation and working on various AI tools such as Python / MATLAB.
2. Programs to solve basic AI problems.
3. Implementation of different AI searching techniques.
4. Implementation of different game playing techniques.
5. Implementation of various knowledge representation techniques.
6. Program to demonstrate the working of Bayesian network.
7. Implementation of pattern recognition problems such as handwritten character/ digit recognition, speech recognition, etc.
8. Implementation of different classification techniques.
9. Implementation of various clustering techniques.
10. Natural language processing tool development.

Note:
TheInstructormayadd/delete/modify/tuneexperiments,whereverhe/shefeelsinajustifiedmanner.

MCA-352N: Software Engineering Lab

Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement.	
CO 2	Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship.	
CO 3	Draw a class diagram after identifying classes and association among them.	
CO 4	Graphically represent various UML diagrams and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially.	
CO 5	Able to use modern engineering tools for specification, design, implementation and testing.	

DETAILED SYLLABUS

For any given case/ problem statement do the following;

1. Prepare a SRS document in line with the IEEE recommended standards.
2. Draw the use case diagram and specify the role of each of the actors.
3. Prepare state the precondition, post condition and function of each use case.
4. Draw the activity diagram.
5. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
6. Draw the sequence diagram for any two scenarios.
7. Draw the collaboration diagram.
8. Draw the state chart diagram.
9. Draw the component diagram.
10. Draw the deployment diagram.

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

MCA-353N: Mini Project

Course Outcome (CO)	

1. Learn to define objective and motivation of your mini - project Work in
2. reference of your Project Title.
3. Learn to explain Hardware and Software technologies used in your project work.
4. Learn to present and explain DFDs of Project (DFD-0, DFD-1, DFD-2 …).
5. Learn to present and explain ER Diagram of Project.
6. Learn to explain Front-End or User Interfaces (One by One) with Purpose and working.
7. Learn to explain Back-End or Database Tables used in your project.
8. Learn to explain Usability or Ultimate output of your project work.
9. Learn to explain Drawback or limitations of your project work.
10. Learn to explain how this work can be carried out in future for improvement.

DETAILED SYLLABUS

** **The Mini Project (6 weeks) conducted during summer break after II semester and will be assessed during III semester. The Course will be carried out at the Institute under the guidance of a Faculty Members.**

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

SECOND YEAR SYLLABUS
SEMESTER-IV

(Elective-3) MCA – 411N: Privacy and Security in Online Social Media

Course Outcome (CO)		
At the end of course, the student will be able to:		
CO 1	Understand working of online social networks	
CO 2	Describe privacy policies of online social media	
CO 3	Analyse countermeasures to control information sharing in Online social networks.	
CO 4	Apply knowledge of identity management in Online social networks	
CO 5	Compare various privacy issues associated with popular social media.	

DETAILED SYLLABUS		4-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Online Social Networks:** Introduction to Social Networks, From offline to Online Communities, Online Social Networks, Evolution of Online Social Networks, Analysis and Properties, Security Issues in Online Social Networks, Trust Management in Online Social Networks, Controlled Information Sharing in Online Social Networks, Identity Management in Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs; Collecting data from Online Social Media.	**08**
II	**Trust Management in Online Social Networks:** Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Social Capital, Trust Evaluation Models, Trust, credibility, and reputations in social systems; Online social media and Policing, Information privacy disclosure, revelation, and its effects in OSM and online social networks; Phishing in OSM & Identifying fraudulent entities in online social networks	**08**
III	**Controlled Information Sharing in Online Social Networks:** Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches	**08**
IV	**Identity Management in Online Social Networks:** Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity thefts, Open Security Issues in Online Social Networks	**08**
V	**Case Study:** Privacy and security issues associated with various social media such as Facebook, Instagram, Twitter, LinkedIn etc.	**08**

Textbooks:

1. Security and Privacy-Preserving in Social Networks, Editors: Chbeir, Richard, Al Bouna, Bechara (Eds.), Spinger, 2013.
2. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco Viviani, Morgan & Claypool publications.
3. Security and Privacy in Social Networks, Editors: Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, A. (Eds.), Springer, 2013
4. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir& Bechara Al Bouna, 2013
5. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013

(Elective-4) MCA – 412N: Internet of Things

Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	
CO 3	Analyze network communication aspects and protocols used in IoT.	
CO 4	Apply IoT for developing real life applications using Ardunio programming.	
CP 5	To develop IoT infrastructure for popular applications	

DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	**08**
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	**08**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	**08**

Text books:

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

(Elective-5) MCA – 413N: Mobile Computing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study and aware fundamentals of mobile computing.	
CO 2	Study and analyze wireless networking protocols, applications and environment.	
CO 3	Understand various data management issues in mobile computing.	
CO 4	Analyze different type of security issues in mobile computing environment.	
CO 5	Study, analyze, and evaluate various routing protocols used in mobile computing.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	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, MAC for cellular system.	**08**
II	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.	**08**
III	Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	**08**
IV	Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment.	**08**
V	Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications	**08**

Suggested Readings:

1. Schiller J., "Mobile Communications", Pearson
2. Upadhyaya S. and Chaudhury A., "Mobile Computing", Springer
3. Kamal R., "Mobile Computing", Oxford University Press.
4. Talukder A. K. and Ahmed H., "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education
5. Garg K., "Mobile Computing Theory and Practice", Pearson.
6. Kumar S., "Wireless and Mobile Communication", New Age International Publishers
7. Manvi S. S. and Kakkasageri M. S., "Wireless and Mobile Networks- Concepts and Protocols", Wiley India Pvt. Ltd.

Project (MCA-451)

Course Outcomes

1. Learn to work in real practical software and industrial development environment where outer world find and access software services for their particular domain in various technologies.
2. Brush-up their knowledge complete in interested areas and software and web technologies.
3. Demonstrate a sound technical knowledge of their selected project topic.
4. Undertake problem identification, formulation and solution.
5. Design engineering solutions to complex problems utilising a systems approach.
6. Conduct an engineering project.
7. Communicate with engineers and the community at large in written an oral forms.
8. Demonstrate the knowledge, skills and attitudes of a professional engineer.
9. Learn to work in a team to accomplish the desired task in time bound and quality frame form.
10. Learn how to create report of project and presentation with professional required skill set.
11. Student learn Presentation Skills, Discussion Skills, Listening Skills, Argumentative Skills, Critical Thinking, Questioning, Interdisciplinary Inquiry, Engaging with Big Questions, Studying Major Works

ELECTIVE-1

(Elective-1) MCA – 314 N: Cryptography & Network Security		
Course Outcome (CO)	**)**	
At the end of course, the student will be able to understand		
CO 1	Understand various security attacks and their protection mechanism.	
CO 2	Apply and analyze various encryption algorithms.	
CO 3	Understand functions and algorithms to authenticate messages and study and apply different digital signature techniques.	
CO 4	Analyze different types of key distributions.	
CO 5	Study and appraise different IP and system security mechanism.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to security attacks, Services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, Cryptanalysis, Steganography, Stream and block ciphers. **Modern Block Ciphers:** Block ciphers principles, Shannon's theory of confusion and diffusion, Feistel structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, Block cipher modes of operations, Triple DES	**08**
II	Introduction to group, field, finite field of the form GF(p), Modular arithmetic, Prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES). Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, Security of RSA	**08**
III	**Message Authentication Codes:** Authentication requirements, Authentication functions, Message authentication code, Hash functions, Birthday attacks, Security of hash functions, Secure hash algorithm (SHA). **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), Proof of digital signature algorithm.	**08**
IV	**Key Management and distribution:** Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. **Authentication Applications:** Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME.	**08**
V	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, Combining security associations, Key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET). **System Security:** Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.	**08**

Suggested Readings:

1. Stallings W., "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Frouzan B. A., "Cryptography and Network Security", McGraw Hill.
3. Kahate A., "Cryptography and Network Security", Tata McGraw Hill.

(Elective-1) MCA-314 N: Data Warehousing & Data Mining		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO1	Demonstrate knowledge of Data Warehouse and its components.	
CO2	Discuss the process of Warehouse Planning and Implementation.	
CO3	Discuss and implement various supervised and Non supervised learning algorithms on data.	
CO4	Explain the various process of Data Mining and decide best according to type of data.	
CO5	Explain process of knowledge discovery in database (KDD). Design Data Mining model.	
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Data Warehousing**: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept.	08
II	**Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	08
III	**Data Mining**: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree	08
IV	**Classification:** Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. **Clustering**: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	08
V	**Data Visualization and Overall Perspective**: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and	

	Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.	08

Suggested Readings:

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH.
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, "Data Warehousing: Architecture and Implementation", Pearson.
3. I.Singh, "Data Mining and Warehousing", Khanna Publishing House.
4. Margaret H. Dunham, S. Sridhar,"Data Mining:Introductory and Advanced Topics" Pearson Education 5. Arun K. Pujari, "Data Mining Techniques" Universities Press.
5. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education

(Elective-1) MCA – 314N : Software Project Management		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Identify project planning objectives, along with various cost/effort estimation models.	
CO 2	Organize & schedule project activities to compute critical path for risk analysis	
CO 3	Monitor and control project activities.	
CO 4	Formulate testing objectives and test plan to ensure good software quality under SEI-CMM	
CO 5	Configure changes and manage risks using project management tools.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Project Evaluation and Project Planning:** Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	**08**
II	**Project Life Cycle and Effort Estimation:** Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.	**08**
III	**Activity Planning and Risk Management:** Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of Critical paths – Cost schedules.	**08**
IV	**Project Management and Control:** Framework for Management and control – Collection of data – Visualizing progress – Costmonitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control Software Configuration Management – Managing contracts – Contract Management.	**08**
V	**Staffing in Software Projects:** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.	**08**

Suggested Readings:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management" – Fifth Edition, McGraw Hill,New Delhi, 2012.
2. Robert K. Wysocki — "Effective Software Project Management" – Wiley Publication, 2011.
3. Walker Royce: — "Software Project Management" - Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, — "Managing Global Software Projects" – McGraw Hill Education (India), FourteenthReprint 2013.
5. Koontz Harold & Weihrich Heinz, "Essentials of Management", McGraw Hill 5th Edition 2008.
6. Robbins and Coulter, "Management", Prentice Hall of India, 9th edition.
7. James A. F., Stoner, "Management", Pearson Education Delhi.
8. P. D. Chaturvedi, "Business Communication", Pearson Education.

(Elective-1) MCA – 314 N: Cloud Computing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.	
CO 2	Develop the ability to understand and use the architecture to compute and storage cloud, service and models.	
CO 3	Understand the application in cloud computing.	
CO 4	Learn the key and enabling technologies that help in the development of cloud.	
CO 5	Explain the core issues of cloud computing such as resource management and security.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing- issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.	08
II	**Cloud Services:** Types of Cloud services: Software as a Service- Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	**Collaborating Using Cloud Services:** Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	**Virtualization for Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.	08
V	**Security, Standards and Applications:** Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	08

Suggested Readings:

6. David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
7. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
8. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing : A Practical Approach", Tata McGraw-Hill 2010.
9. Haley Beard, "Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.
10. G. J. Popek, R.P. Goldberg, "Formal requirements for virtualizable third generation Architectures, Communications of the ACM", No.7 Vol.17, July 1974

(Elective-1) MCA – 314N : Compiler Design		
Course Outcome (CO)		
At the end of course , the student will be able to:		
CO 1	Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.	
CO 2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.	
CO 3	Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.	
CO 4	Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.	
CO 5	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	**08**
II	**Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	**08**
III	**Syntax-directed Translation:** Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	**08**
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	**08**
V	**Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	**08**

Text books:

1. K. Muneeswaran,Compiler Design,First Edition,Oxford University Press.
2. J.P. Bennet, “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill,2003.
3. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
4. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools”, Pearson Education
5. V Raghvan, “ Principles of Compiler Design”, TMH
6. Kenneth Louden,” Compiler Construction”, Cengage Learning.
7. Charles Fischer and Ricard LeBlanc,” Crafting a Compiler with C”, Pearson Education

ELECTIVE-2

(Elective-2) MCAN – 315: Web Technology		
Course Outcome (CO)		
At the end of course, the student will be able to:		
CO 1	Apply the knowledge of HTML and CSS to develop web application and analyze the insights of internet programming to implement complete application over the web.	
CO 2	Understand, analyze and apply the role of JavaScript in the workings of the web and web applications.	
CO 3	Understand, analyze and build dynamic web applications using servlet and JSP.	
CO 4	Develop Spring-based Java applications using Java configuration, XML configuration, annotation-based configuration, beans and their scopes, and properties.	
CO 5	Develop web application using Spring Boot and RESTFul Web Services	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Web Page Designing:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, HTML-Introduction, HTML Tags, HTML-Grouping Using Div & Span, HTML-Lists, HTML-Images, HTML-Hyperlink, HTML-Table, HTML-Iframe, HTML-Form, Introduction of CSS, CSS Syntax, External Style Sheet using < link >, Multiple Style Sheets, Value Lengths and Percentages, CSS-Selectors, CSS-Box Model, Floats, Clear, Introduction to Bootstrap.	**08**
II	**Scripting:** Introduction to JavaScript, Creating Variables in JavaScript, Creating Functions in JavaScript, UI Events, Returning Data from Functions, Working with Conditions, looping in JavaScript, Block Scope Variables, Working with Objects, Creating Object using Object Literals, Manipulating DOM Elements with JavaScript	**08**
III	**Web Application development using JSP & Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.	**08**
IV	**Spring:** Spring Core Basics-Spring Dependency Injection concepts, Introduction to Design patterns, Factory Design Pattern, Strategy Design pattern, Spring Inversion of Control, AOP, Bean Scopes- Singleton, Prototype, Request, Session, Application, WebSocket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles	**08**
V	**Spring Boot:** Spring Boot- Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications	**08**

Text books:

1. Burdman, Jessica, “Collaborative Web Development” Addison Wesley
2. Xavier, C, “Web Technology and Design” , New Age International
3. Ivan Bayross,” HTML, DHTML, Java Script, Perl & CGI”, BPB Publication
4. Bhave, “Programming with Java”, Pearson Education
6. Hans Bergsten, “Java Server Pages”, SPD O’Reilly
7. Naughton, Schildt, “The Complete Reference JAVA2”, TMH
8. Craig Walls, “Spring Boot in Action”

(Elective-2) MCA – 315N: Big Data		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO1	Demonstrate knowledge of Big Data Analytics concepts and its applications in business.	
CO2	Demonstrate functions and components of Map Reduce Framework and HDFS.	
CO3	Develop queries in NoSQL environment.	
CO4	Explain process of developing Map Reduce based distributed processing applications.	
CO5	Explain process of developing applications using HBASE, Hive, Pig etc.	
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	**08**
II	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. **Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	**08**
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	**08**
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **NoSQL** Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections **Spark**: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN **SCALA:** Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	**08**
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **Hive** - Apache Hive architecture and installation, Hive shell, Hive services, Hive	**08**

	metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.	

Suggested Readings:

19. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
20. Big-Data Black Book, DT Editorial Services, Wiley.
21. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill.
22. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
23. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons
24. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT
25. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP
26. Tom White, "Hadoop: The Definitive Guide", O'Reilly.
27. Eric Sammer, "Hadoop Operations", O'Reilly.
28. Chuck Lam, "Hadoop in Action", MANNING Publishers
29. Deepak Vohra, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools", Apress
30. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly
31. Lars George, "HBase: The Definitive Guide", O'Reilly.
32. Alan Gates, "Programming Pig", O'Reilly.
33. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
34. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons.
35. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons
36. Pete Warden, "Big Data Glossary", O'Reilly

(Elective-2) MCA – 315N : Simulation and Modelling		
Course Outcome (CO)		
At the end of course , the student will be able to understand		
CO 1	Study the concept of system, its components and types.	
CO 2	Understand and analyze nature and techniques of major simulation models.	
CO 3	Study and analyze the idea of continuous and discrete system simulation.	
CO 4	Understand the notion of system dynamics and system dynamics diagrams.	
CO 5	Finding critical path computation and understanding PERT networks	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	System definition and components, stochastic activities, continuous and discrete systems, System modeling, Types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.	**08**
II	System simulation, Need of simulation, Basic nature of simulation, techniques of simulation, comparison of simulation and analytical methods, types of system Simulation, real time simulation, hybrid simulation, simulation of pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag model, Cobweb model.	**08**
III	Simulation of continuous Systems, analog vs digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an auto-pilot. Discrete system simulation, fixed time step vs. event-to-event model, generation of random numbers, test of randomness, Monte-Carlo computation vs. stochastic simulation.	**08**
IV	System dynamics, exponential growth models, exponential decay models, logistic curves, system dynamics diagrams, world model.	**08**
V	Simulation of PERT networks, critical path computation, uncertainties in activity duration, resource allocation and consideration, Simulation languages, object oriented simulation	**08**

Suggested Readings:

1. Geoffrey Gordon, “System Simulation”, PHI
2. Narsingh Deo, “System Simulation with digital computer”, PHI.
3. Averill M. Law and W. David Kelton, “Simulation Modelling and Analysis”, TMH.

(Elective-2) MCA – 315N: Software Testing & Quality Assurance		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Test the software by applying testing techniques to deliver a product free from bugs.	
CO 2	Investigate the scenario and select the proper testing technique.	
CO 3	Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.	
CO 4	Understand how to detect, classify, prevent and remove defects.	
CO 5	Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Software Testing Basics:** Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.	**08**
II	**Testing Techniques and Levels of Testing:** Using White Box Approach to Test design– Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.	**08**
III	**Software Test Automation And Quality Metrics:** Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.	**08**
IV	**Fundamentals of Software Quality Assurance:** SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.	**08**
V	**Software Assurance Models:** Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM. **Software Quality Assurance Trends:** Software Process- PSP and TSP, OO Methodology, Clean room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their affect on Software Quality.	**08**

Suggested Readings:

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson.
2. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson

Addison Wesley.
3. Aditya P. Mathur, “Foundations of Software Testing”, Pearson.
4. Paul Ammann, Jeff Offutt, “Introduction to Software Testing”, Cambridge University Press.
5. Paul C. Jorgensen, “Software Testing: A Craftsman's Approach”, Auerbach Publications.
6. William Perry, “Effective Methods of Software Testing”, Wiley Publishing, Third Edition.
7. Renu Rajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill.
8. Stephen Kan, “Metrics and Models in Software Quality”, Addison – Wesley, Second Edition.
9. S. A. Kelkar, “Software quality and Testing”, PHI Learning Pvt, Ltd.
10. Watts S Humphrey, “Managing the Software Process”, Pearson Education Inc.

(Elective-2) MCA – 315N: Digital Image Processing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Explain the basic concepts of two-dimensional signal acquisition, sampling, quantization and color model.	
CO 2	Apply image processing techniques for image enhancement in both the spatial and frequency domains.	
CO 3	Apply and compare image restoration techniques in both spatial and frequency domain.	
CO 4	Compare edge based and region based segmentation algorithms for ROI extraction.	
CO 5	Explain compression techniques and descriptors for image processing.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Digital Image Fundamentals:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	**08**
II	**Image Enhancement:** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	**08**
III	**Image Restoration:** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics –Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	**08**
IV	**Image Segmentation:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	**08**
V	**Image Compression and Recognition:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	**08**

Suggested Readings:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Third Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.
3. Kenneth R. Castleman, "Digital Image Processing" Pearson, 2006.
4. D, E. Dudgeon and R M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, "Digital Image Processing" John Wiley, New York, 2002.
6. Milan Sonka et al, "Image processing, analysis and machine vision Brookes/Cole", Vikas Publishing House, 2nd edition,1999.

MCA-351N: Artificial Intelligence Lab		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study and understand AI tools such as Python / MATLAB.	
CO 2	Apply AI tools to analyze and solve common AI problems.	
CO 3	Implement and compare various AI searching algorithms.	
CO 4	Implement various machine learning algorithms.	
CO 5	Implement various classification and clustering techniques.	

DETAILED SYLLABUS

11. Installation and working on various AI tools such as Python / MATLAB.
12. Programs to solve basic AI problems.
13. Implementation of different AI searching techniques.
14. Implementation of different game playing techniques.
15. Implementation of various knowledge representation techniques.
16. Program to demonstrate the working of Bayesian network.
17. Implementation of pattern recognition problems such as handwritten character/ digitrecognition, speech recognition, etc.
18. Implementation of different classification techniques.
19. Implementation of various clustering techniques.
20. Natural language processing tool development.

Note:
TheInstructormayadd/delete/modify/tuneexperiments,whereverhe/shefeelsinajustifiedmanner.

MCA-352N: Software Engineering Lab		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement.	
CO 2	Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship.	
CO 3	Draw a class diagram after identifying classes and association among them.	
CO 4	Graphically represent various UML diagrams and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially.	
CO 5	Able to use modern engineering tools for specification, design, implementation and testing.	

DETAILED SYLLABUS

For any given case/ problem statement do the following;

1. Prepare a SRS document in line with the IEEE recommended standards.
2. Draw the use case diagram and specify the role of each of the actors.
3. Prepare state the precondition, post condition and function of each use case.
4. Draw the activity diagram.
5. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
6. Draw the sequence diagram for any two scenarios.
7. Draw the collaboration diagram.
8. Draw the state chart diagram.
9. Draw the component diagram.
10. Draw the deployment diagram.

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

(Elective-3) MCA – 411N: Soft Computing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Recognize the need of soft computing and study basic concepts and techniques of soft computing.	
CO 2	Understand the basic concepts of artificial neural network to analyze widely used neural networks.	
CO 3	Apply fuzzy logic to handle uncertainty in various real-world problems.	
CO 4	Study various paradigms of evolutionary computing and evaluate genetic algorithm in solving optimization problems.	
CO 5	Apply hybrid techniques in applications of soft computing.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Soft Computing:** Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing. **Artificial Neural Networks:** Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network architectures, Activation functions, Characteristics and limitation of neural networks.	**08**
II	**Artificial Neural Networks:** Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic. **Major classes of neural networks:** Perceptron networks, Multilayer perceptron model, Back-propagation network, Radial basis function network, Recurrent neural network, Hopfield networks, Kohonen self-organizing feature maps.	**08**
III	**Fuzzy Logic:** Introduction to Fuzzy Logic, Comparison with crisp logic, Properties of classical sets, Operations on classical sets, Properties of fuzzy sets, Operations on fuzzy sets, Classical relations, Fuzzy relations, Features and types of fuzzy membership functions, Fuzzy arithmetic, Fuzzy measures. **Fuzzy Systems:** Crisp logic, Predicate logic, Fuzzy logic, Fuzzy propositions, Inference rules, Fuzzy inference systems- Fuzzification, Inference, Defuzzification, Types of inference engines.	**08**
V	**Evolutionary Computing:** Introduction, Evolutionary algorithm, Biological evolutionary process, Paradigms of evolutionary computing – Genetic algorithm and Genetic programming, Evolutionary strategies, Evolutionary programming. **Genetic Algorithm:** Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations- Encoding, Selection, Crossover and Mutation, Classification of Genetic algorithm.	**08**
V	**Hybrid Soft Computing Techniques:** Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy-genetic hybrid systems. **Other Soft Computing Techniques:** Tabu Search, Ant colony based	**08**

	optimization, Swarm Intelligence.	

Suggested Readings:

1. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley-India.
2. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications", PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., "Concepts of Soft Computing- Fuzzy and ANN with Programming", Springer.
4. Kaushik S. and Tiwari S., "Soft Computing – Fundamentals, Techniques and Applications', McGrawHill Education.
5. Jang J.-S.R., Sun C.-T. and Mizutani E., "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.
6. Karray F. O. and Silva C. D., "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications", Pearson Education.
7. Freeman J. A. and Skapura D. M., "Neural Networks: Algorithms, Applications and Programming Techniques", Pearson.
8. Siman H., "Neural Netowrks", Prentice Hall of India.

(Elective-3) MCA – 411N: Pattern Recognition		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition.	
CO 2	Analysis the Statistical Patten Recognition.	
CO 3	Understanding the different Parameter estimation methods.	
CO 4	Understanding the different Nonparametric Techniques.	
CO 5	Understand and Make use of unsupervised learning and Clustering in Pattern recognition.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	**08**
II	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers, Normal density and discriminant functions	**08**
III	**Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	**08**
IV	**Nonparametric Techniques:** Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.	**08**
V	**Unsupervised Learning & Clustering:** Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.	**08**

Suggested Readings:

1. Duda R. O., Hart P. E. and Stork D. G., "Pattern Classification", John Wiley.
2. Bishop C. M., "Neural Network for Pattern Recognition", Oxford University Press.
3. Singhal R., "Pattern Recognition: Technologies & Applications", Oxford University Press.
4. Theodoridis S. and Koutroumbas K., "Pattern Recognition", Academic Press.

(Elective-3) MCA – 411N: Data Analytics		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO1	Describe the life cycle phases of Data Analytics through discovery, planning and building.	
CO2	Understand and apply Data Analysis Techniques.	
CO3	Implement various Data streams.	
CO4	Understand item sets, Clustering, frame works & Visualizations.	
CO5	Apply R tool for developing and evaluating real time applications.	
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Data Analytics**: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle**: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization	08
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, Neural Networks: Learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	08
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – Real time sentiment analysis, stock market predictions.	08
IV	**Frequent Itemsets and Clustering:** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, Clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	08
V	**Frame Works and Visualization**: MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. **Introduction to R** - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08

Suggested Readings:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.
3. Bill Franks, "Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams

with Advanced Analytics", John Wiley & Sons.
4. John Garrett, "Data Analytics for IT Networks : Developing Innovative Use Cases", Pearson Education.
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
6. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley.
7. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series.
8. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier.
9. Michael Berthold, David J. Hand," Intelligent Data Analysis", Springer.
10. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill.
11. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer.
12. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication.
13. Pete Warden, "Big Data Glossary", O'Reilly.
14. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons.
15. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press.
16. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier.

(Elective-3) MCA – 411N: Software Quality Engineering

Course Outcome (CO)		
At the end of course, the student will be able to:		
CO 1	Understand basic concepts of Software Quality along with its documents and process	
CO 2	Apply knowledge of Software Quality in various types of software	
CO 3	Compare the various reliability models for different scenarios	
CO 4	Illustrate the software Quality Planning and Assurance	
CO 5	Make use of various testing techniques in software implementation	

DETAILED SYLLABUS		4-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Software Quality**: Definition, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.	**08**
II	**Software Quality Metrics Product Quality Metrics**: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.	**08**
III	**Software Quality Management and Models**:Modeling Process, Software **Reliability Models**: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.	**08**
IV	**Software Quality Assurance**: Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.	**08**
V	**Software Verification, Validation & Testing:** Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.	**08**

Text books:

1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Interscience, 2005; ISBN 0-471-71345 -7
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, AddisonWesley (2002), ISBN: 0201729156
3. Norman E. Fenton and Shari Lawrence Pfleeger, “Software Metrics” Thomson, 2003
4. Mordechai Ben – Menachem and Garry S.Marliss, “Software Quality”, Thomson Asia Pte Ltd, 2003.

ELECTIVE-4

(Elective-4) MCA – 412N: Blockchain Architecture		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO1	Study and understand basic concepts of blockchain architecture.	
CO2	Analyze various requirements for consensus protocols.	
CO3	Apply and evaluate the consensus process.	
CO4	Understand the concepts of Hyperledger fabric.	
CO5	Analyze and evaluate various use cases in financial software and supply chain.	
	DETAILED SYLLABUS	**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Blockchain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Blockchain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hashchain to Blockchain, Bitcoin Basic, Basic consensus mechanisms.	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. **Permissioned Blockchains:** Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric:** Decomposing the consensus process, Hyperledger fabric components. **Chaincode Design and Implementation Hyperledger Fabric:** Beyond Chaincode: fabric SDK and Front End, Hyperledger composer tool.	**08**
IV	**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance. **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	**08**
V	**Use case 3:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Suggested Readings:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly
2. Melanie Swa, "Blockchain", O'Reilly
3. "Hyperledger Fabric", https://www.hyperledger.org/projects/fabric
4. Bob Dill, David Smits, "Zero to Blockchain - An IBM Redbooks course", https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

(Elective-4) MCA – 412N: Neural Networks		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study of basic concepts of Neuro Computing, Neuroscience and ANN. Understand the different supervised and unsupervised and neural networks performance.	
CO 2	Study of basic Models of neural network. Understand the Perception network. and Compare neural networks and their algorithm.	
CO 3	Study and Demonstrate different types of neural network. Make use of neural networks for specified problem domain.	
CO 4	Understand and Identify basic design requirements of recurrent network and Self-organizing feature map.	
CO 5	Able to understand the some special network. Able to understand the concept of Soft computing.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Neurocomputing and Neuroscience**: The human brain, biological neurons, neural processing, biological neural network. **Artificial Neural Networks:** Introduction, historical notes, neuron model, knowledge representation, comparison with biological neural network, applications. **Learning process:** Supervised learning, unsupervised learning, error correction learning, competitive learning, adaptation learning, Statistical nature of the learning process.	**08**
II	**Basic Models:** McCulloch-Pitts neuron model, Hebb net, activation functions, aggregation functions. **Perceptron networks:** Perceptron learning, single layer perceptron networks, multilayer perceptron networks. Least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.	**08**
III	**Multilayer neural network:** Introduction, comparison with single layer networks. **Back propagation network**: Architecture, back propagation algorithm, local minima and global minima, heuristics for making back propagation algorithm performs better, applications. **Radial basis function network**: Architecture, training algorithm, approximation properties of RBF networks, comparison of radial basis function network and back propagation networks.	**08**
IV	**Recurrent network**: Introduction, architecture and types. **Self-organizing feature map**: Introduction, determining winner, Kohonen Self Organizing feature maps (SOM) architecture, SOM algorithm, properties of feature map; Learning vector quantization-architecture and algorithm. Principal component and independent component analysis.	**08**
V	**Special networks:** Cognitron, Support vector machines. Complex valued NN and complex valued BP. **Soft computing:** Introduction, Overview of techniques, Hybrid soft computing techniques.	**08**

Suggested Readings:

1. Kumar S., "Neural Networks- A Classroom Approach", McGraw Hill.
2. Haykin S., "Neural Networks – A Comprehensive Foundation", Pearson Education.
3. Yegnanarayana B. "Artificial Neural Networks", Prentice Hall of India.
4. Freeman J. A., "Neural Networks", Pearson Education.
5. James F., "Neural Networks – Algorithms, Applications and Programming Techniques", Pearson Education.

(Elective-4) MCA – 412N: Internet of Things

Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	
CO 3	Analyze network communication aspects and protocols used in IoT.	
CO 4	Apply IoT for developing real life applications using Ardunio programming.	
CP 5	To develop IoT infrastructure for popular applications	

DETAILED SYLLABUS		4-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	**08**
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	**08**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	**08**

Text books:

7. Olivier Hersent,DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
8. Jeeva Jose, Internet of Things, Khanna Publishing House
9. Michael Miller "The Internet of Things" by Pearson
10. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
11. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPIpublications,2014
12. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

(Elective-4) MCA – 412N: Modern Application Development

Course Outcome (CO)		
At the end of course , the student will be able to:		
CO 1	Understand the fundamental of Kotlin Programing for Android Application Development.	
CO 2	Describe the UI Layout and architecture of Android Operating System.	
CO 3	Designing android application using Jetpack Library based on MVVM Architecture.	
CO 4	Developing android application based on REST API using Volley and Retrofit Library.	
CO 5	Ability to debug the Performance and Security of Android Applications.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Kotlin Fundamental:** Introduction to Kotlin,Basic Syntax, Idioms, Coding Conventions, Basics, Basic Types, Packages, Control Flow, Returns and Jumps, Classes and Objects, Classes and Inheritance, Properties and Fields, Interfaces, Visibility Modifiers, Extensions, Data Classes, Generics, Nested Classes, Enum Classes, Objects, Delegation, Delegated Properties, Functions and Lambdas, Functions, Lambdas, Inline Functions, Higher-Order Functions, Scope Functions, Collections, Ranges, Type Checks and Casts, This expressions, Equality, Operator overloading, Null Safety, Exceptions, Annotations, Reflection.	**08**
II	**Android Fundamental: Android Architecture**: Introduction to Android, Layouts, Views and Resources, Activities and Intents, Activity Lifecycle and Saving State, Implicit or Explicit Intents. **User Interaction and Intuitive Navigation:** Material Design, Theme, Style and Attributes, Input Controls, Menus, Widgets, Screen Navigation, Recycler View, ListView, Adapters,Drawables, Notifications.	**08**
III	**Storing, Sharing and Retrieving Data in Android Applications:** Overview to storing data, shared preferences, App settings, Store and query data in Android's SQLite database, Content Providers, Content Resolver, Loading data using loaders. **Jetpack Components :** Fragments, Jetpack Navigation, Lifecycle, Lifecycle Observer, Lifecycle Owner, View Model, View Model Factory, View Model Provider, LiveData, Room API, Data Binding, View Binding, MVVM Architecture Basics	**08**
IV	**Asynchronous Data Handling, Networking and Files:** Asynchronous Task, Coroutines, API Handling, JSON Parsing, Volley Library, Retrofit Library, File Handling, HTML and XML Parsing, Broadcast receivers, Services	**08**

V	**Permissions, Performance and Security:** Firebase, AdMob, APK Singing, Publish App, Packaging and deployment, Google Maps, GPS and Wi-Fi, Download Manager, Work Manager, Alarms, Location, Map and Sensors, APK Singing, Publish App	**08**

Text books:

1. Meier R.,"Professionai Android 2 Application Development", Wiley.
2. Hashimi S., KomatineniS. and MacLeanD., "Pro Android 2", Apress.
3. Murphy M., "Beginning Android 2", Apress.
4. Delessio C. and Darcey L., "Android Application Development", Pearson Education.
5. DiMarzio J.F., "Android a Programming Guide", Tata McGraw Hill.

(Elective-4) MCA – 412N: Distributed Database Systems		
Course Outcome (CO)		
At the end of course , the student will be able to:		
CO 1	Understand theoretical and practical aspects of distributed database systems.	
CO 2	Study and identify various issues related to the development of distributed database system	
CO 3	Understand the design aspects of object-oriented database system and related development	
CO 4	Equip students with principles and knowledge of distributed reliability.	
CO 5	Equip students with principles and knowledge of parallel and object-oriented databases.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	**08**
II	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms.	**08**
III	Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	**08**
IV	**Distributed DBMS Reliability:** Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	**08**
V	**Distributed object Database Management Systems:** Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:** Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	**08**
Text books: M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001. 2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill. REFERENCE BOOKS: 1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition		

ELECTIVE-5

(Elective-5) MCA – 413N: Mobile Computing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study and aware fundamentals of mobile computing.	
CO 2	Study and analyze wireless networking protocols, applications and environment.	
CO 3	Understand various data management issues in mobile computing.	
CO 4	Analyze different type of security issues in mobile computing environment.	
CO 5	Study, analyze, and evaluate various routing protocols used in mobile computing.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	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, MAC for cellular system.	**08**
II	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.	**08**
III	Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	**08**
IV	Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment.	**08**
V	Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications	**08**

Suggested Readings:

8. Schiller J., "Mobile Communications", Pearson
9. Upadhyaya S. and Chaudhury A., "Mobile Computing", Springer
10. Kamal R., "Mobile Computing", Oxford University Press.
11. Talukder A. K. and Ahmed H., "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education
12. Garg K., "Mobile Computing Theory and Practice", Pearson.
13. Kumar S., "Wireless and Mobile Communication", New Age International Publishers
14. Manvi S. S. and Kakkasageri M. S., "Wireless and Mobile Networks- Concepts and Protocols", Wiley India Pvt. Ltd.

(Elective-5) MCA – 413N: Computer Graphics and Animation

Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Understand the graphics hardware used in field of computer graphics.	
CO 2	Understand the concept of graphics primitives such as lines and circle based on different algorithms.	
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	
CO 4	Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.	
CO 5	Perform the concept of multimedia and animation in real life.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	**08**
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.	**08**
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping. **Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	**08**
IV	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	**08**
V	**Multimedia Systems:** Design Fundamentals, Back ground of Art, Color theory overview, Sketching & illustration, Storyboarding, different tools for animation. **Animation:** Principles of Animations, Elements of animation and their use, Power of Motion, Animation Techniques, Animation File Format, Making animation for Rolling Ball, making animation for a Bouncing Ball, Animation for the web, GIF, Plugins and Players, Animation tools for World Wide Web.	**08**

Suggested Readings:

1. Hearn D. and Baker M. P., "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes,"Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill
4. Newman W. M., Sproull R. F., "Principles of Interactive computer Graphics", McGraw Hill.
5. Sinha A. N. and Udai A. D.," Computer Graphics", McGraw Hill.
6. Mukherjee, "Fundamentals of Computer graphics & Multimedia", PHI Learning Private Limited.
7. Vaughan T., "Multimedia, Making IT Work",Tata McGraw Hill.

(Elective-5) MCA – 413N: Natural Language Processing		
Course Outcome (CO)		
At the end of course, the student will be able to understand		
CO 1	Study and understand basic concepts, background and representations of natural language.	
CO 2	Analyze various real-world applications of NLP.	
CO 3	Apply different parsing techniques in NLP.	
CO 4	Understand grammatical concepts and apply them in NLP.	
CO 5	Apply various statistical and probabilistic grammar methods to handle and evaluate ambiguity.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Natural Language Understanding:** The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.	**08**
II	Introduction to semantics and knowledge representation, some applications like machine translation, database interface.	**08**
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	**08**
IV	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	**08**
V	**Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	**08**

Suggested Readings:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", Pearson Education.
3. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education.
4. L. M. Ivansca, S. C. Shapiro, "Natural Language Processing and Language Representation", AAAI Press, 2000.
5. T. Winograd, Language as a Cognitive Process, Addison-Wesley.

(Elective-5) MCA – 413N: Machine Learning Techniques		
Course Outcome (CO)		
At the end of course , the student will be able:		
CO 1	To understand the need for machine learning for various problem solving	
CO 2	To understand a wide variety of learning algorithms and how to evaluate models generated from data	
CO 3	To understand the latest trends in machine learning	
CO 4	To design appropriate machine learning algorithms and apply the algorithms to a real-world problems	
CO 5	To optimize the models learned and report on the expected accuracy that can be achieved by applying the models	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION** – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	**08**
II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING -** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel,and Gaussiankernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	**08**
III	**DECISION TREE LEARNING** - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	**08**
IV	**ARTIFICIAL NEURAL NETWORKS** – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING** - Introduction,concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	**08**
V	**REINFORCEMENT LEARNING**–Introduction to Reinforcement Learning , Learning Task,Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process , Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning,Introduction to Deep Q Learning.	**08**

	GENETIC ALGORITHMS: Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications.	

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
5. M. Gopal, "Applied Machine Learning", McGraw Hill Education

(Elective-5) MCA – 413N: Quantum Computing

Course Outcome (CO)		
At the end of course , the student will be able to understand		
CO 1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	
CO 2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.	
CO 3	Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).	
CO 4	Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.	
CO 5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.	
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	**08**

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import,
3 Oct 2014 3. Computing since Democritus by Scott Aaronson
4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

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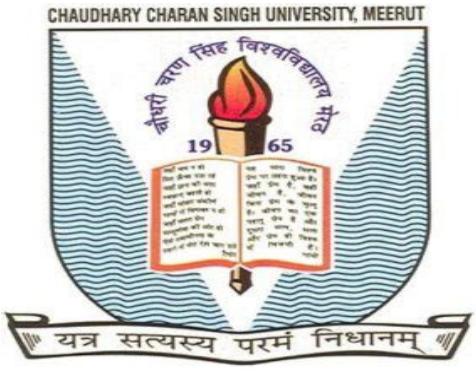

EVALUATION SCHEME &SYLLABUS

Third Year

(Master of Computer Applications)

On

Choice Based Credit System

(Effective from the Session: 2018-19)

Master of Computer Applications 2018-19

FIFTH SEMESTER

Sl. No.	Subject Code	Subject Name	Periods			Evaluation Scheme					Credit
			L	T	P	Sessional			ESE	Total	
						CT	TA	Total			
1.	MCA-511	Computer Graphics & Animation	3	1	0	20	10	30	70	100	04
2.	MCA-512	Software Engineering	3	1	0	20	10	30	70	100	04
3.	MCA- 513	Software Testing Elective – II	3	1	0	20	10	30	70	100	04
4.	MCA- 514	Cloud computing Elective-III	3	1	0	20	10	30	70	100	04
5.	MCA- 515	Big Data Elective – IV	3	1	0	20	10	30	70	100	03
Practical											
7.	MCA-551	Computer Graphics & Animation Lab	0	0	6	30	20	50	50	100	03
8.	MCA-552	Project Based on Software Engineering	0	0	3	30	20	50	50	100	02
		Total	15	5	9					700	24

SIXTH SEMESTER

Sl. No.	Subject Code	Subject Name	Period			Evaluation Scheme					Credit
			L	T	P	Session Exams			ESE	Total	
						CT	TA	Total			
1	MCA-611	Colloquium	0	0	8	-	100	100	-	100	04
2	MCA-612	Industrial Project	0	0	40	-	250	250	350	600	20
		Total	0	0	48					700	24

MCA V Semester Electives

Elective : II

1. RCA-E21 : Cryptography and Network Security
2. RCA-E22 : Natural language Processing
3. RCA-E23 : Human Computer Interaction
4. RCA-E24 : Software Testing
5. RCA-E25 : Modern Application Development

Elective: III

1. RCA-E31 : Cloud Computing
2. RCA-E32 : Soft Computing
3. RCA-E33 : Information Storage Management
4. RCA-E34 : Digital Image Processing
5. RCA-E35 : Distributed Systems

Elective : IV

1. RCA-E41 : Distributed Database Systems
2. RCA-E42 : Simulation and Modeling
3. RCA-E43 : Real Time Systems
4. RCA-E44 : Pattern Recognition
5. RCA-E45 : Big Data

Computer Graphics and Animation (MCA-511)

Course Outcomes

1. Understand the basics of computer graphics,various graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniquesfordisplayof3D scene on 2D screen.
6. Render projected objects to naturalize the scene in 2 D view and use of illumination models for this.

UNIT-I: (8)

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, two-dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, mid-point circle drawing algorithm; Filled area algorithms: Scan line: Polygon filling algorithm, boundary filled algorithm.

UNIT-II: (8)

Two/Three-Dimensional Viewing: The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms): - 4-bit code algorithm, Sutherland-Cohen algorithm, parametric line clipping algorithm (Cyrus Beck). Polygon clipping algorithm: Sutherland-Hodgeman polygon clipping algorithm. Two dimensional transformations: transformations, translation, scaling, rotation, reflection, composite transformation. Three dimensional transformations: Three-dimensional graphics concept, Matrix representation of 3 D Transformations, Composition of 3-D transformation.

UNIT-III: (8)

Viewing in 3D: Projections, types of projections, mathematics of planner geometric projections, coordinate systems.
Hidden surface removal: Introduction to hidden surface removal. Z- buffer algorithm, scanline algorithm, area sub-division algorithm.

UNIT-IV: (8)

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency. What is an image? Filtering, image processing, geometric transformation of images.

UNIT- V: (8)

Animation; Fundamentals of computer animation, Animation Techniques. Animation and Flash Overview, Using Layer and Creating Animation

REFRENCES:

1. Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition.
2. Fundamentals of 3Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.
3. Computer Graphics: Secrets and Solutions by Corrign John, BPB
4. M.C. Trivedi, NN Jani, Computer Graphics, Jaico Publications
5. Rishabh Anand, Computer Graphics- A practical Approach, Khanna Publishing House
6. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
7. Computer Graphics Secrets and solutions by Corrign John, 1994, BPV
8. Principles of Multimedia by Ranjan Parekh, McGrawHill Education
9. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, StevanK. Feiner and Johb F. Hughes, 2000, Addision Wesley.
10. Computer Graphics by Donald Hearn and M.Pauline Baker, 2nd Edition, 1999, PHI
11. Computer graphics, Multimedia and Animation by Malay. K.Pakhira, PHI, 2nd Edition, 2010

Software Engineering (MCA-512)

Course Outcomes

1. Explain various software characteristics and analyze different software Development Models.
2. Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards.
3. Compare and contrast various methods for software design.
4. Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing.
5. Manage software development process independently as well as in teams and make use of various software management tools for development, maintenance and analysis.

UNIT-I: **(8)**

Introduction: Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

UNIT-II: **(8)**

Software Requirement Specifications (SRS): Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS.

Software Quality Assurance :(SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

UNIT-III:

Software Design: **(8)**

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. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs

UNIT-IV: **(8)**

Software Testing: Testing Objectives, UNIT Testing, Integration Testing, 8 Acceptance Testing, Regression Testing, Testing for functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

UNIT-V: **(8)**

Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource allocation Models, Software Risk Analysis and Management.

REFRENCES:

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

5. Deepak Jain," Software Engineering: Principles and Practices",Oxford University Press.
6. Munesh C. Trivedi, Software Engineering, Khanna Publishing House
7. N.S. Gill, Software Engineering, Khanna Publishing House

Software Testing (MCA-513)

Course Outcomes

1. Apply various software testing methods.
2. Prepare test cases for different types and levels of testing.
3. Prepare test plan for an application.
4. Identify bugs to create defect report of given application.
5. Test software for performance measures using automated testing tools.

UNIT-I **(8)**

Review of Software Engineering: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, Test Cases, Testing Suite, Test Oracles, Impracticality of Testing All data; Impracticality of testing All Paths. Verification: Verification methods, SRS verification, Source code reviews, User documentation verification, and Software project audit, Tailoring Software Quality Assurance Program by Reviews, Walkthrough, Inspection, and Configuration Audits.

UNIT–II **(8)**

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique. Structural Testing: Control flow testing, Path testing, Independent paths, Generation of graph from program, Identification of independent paths, Cyclomatic Complexity, Data Flow Testing, Mutation Testing.

UNIT-III **(8)**

Regression Testing: What is Regression Testing? Regression Test cases selection, reducing the number of test cases, Code coverage prioritization technique. Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis.

UNIT-IV **(8)**

Software Testing Activities: Levels of Testing, Debugging, Testing techniques and their Applicability, Exploratory Testing Automated Test Data Generation: Test Data, Approaches to test data generation, test data generation using genetic algorithm, Test Data Generation Tools, Software Testing Tools, and Software test Plan.

UNIT-V **98)**

Object oriented Testing: Definition, Issues, Class Testing, Object Oriented Integration and System Testing. Testing Web Applications: What is Web testing?, User interface Testing, Usability Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing.

REFRENCES:

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012
2. K..K. Aggarwal &Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.
3. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
4. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.
5. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.

Cloud Computing (MCA-514)

Course Outcomes

1. Understand the concepts of Cloud Computing, key technologies, Strengths and limitations of cloud computing.
2. Develop the ability to understand and use the architecture to compute and storage cloud, service and models.
3. Understand the application in cloud computing.
4. Learn the key and enabling technologies that help in the development of cloud.
5. Explain the core issues of cloud computing such as resource management and security.

UNIT-I **(8)**

Introduction: Cloud-definition, benefits, usage scenarios, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing- issues in Clouds - Eucalyptus - Nimbus - Open Nebula, Cloud Sim.

UNIT-II **(8)**

Cloud Services: Types of Cloud services: Software as a Service-Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.

UNIT-III **(8)**

Collaborating Using Cloud Services: Email Communication over the Cloud - CRM Management - Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.

UNIT-IV **(8)**

Virtualization for Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System Vim, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.

UNIT-V **(8)**

Security, Standards and Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

REFRENCES:

1. David E.Y. Sarna Implementing and Developing Cloud Application, CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing : A Practical Approach, Tata McGraw-Hill 2010.
4. Haley Beard, Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.
5. G.J.Popek, R.P. Goldberg, Formal requirements for virtualizable third generation Architectures, Communications of the ACM, No.7 Vol.17, July 1974
6. John Rittinghouse & James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.
7. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Que Publishing, August 2008.
8. James E Smith, Ravi Nair, Virtual Machines, Morgan Kaufmann Publishers, 2006.

Big Data (MCA-515)

Course Outcomes

1. To Understand the Big Data challenges & opportunities and its applications area.
2. Understand data to big data generation, types and development.
3. Gain conceptual understanding of NOSQL Database.
4. Understanding of concepts of map and reduce and functional programming.
5. Gain conceptual understanding of Hadoop Distributed File System.

UNIT-I **(8)**

Understanding big data: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data ,credit risk management, big data and algorithmic trading, big data and HealthCare, big data in medicine, advertising and big data, big data technologies, Introduction to Hadoop, open source technologies, cloud and big data mobile business intelligence, Crowd sourcing Analytics ,inter and trans firewall analytics

UNIT-II **(8)**

NoSQL data management: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases ,materialized views, distribution models ,sharing , masters slave replication , peer-peer replication , sharing and replication , consistency , relaxing consistency , version stamps , map reduce , partitioning and combining , composing map-reduce calculations

UNIT-III **(8)**

Basics of Hadoop; Data format, analyzing data with Hadoop, scaling out , Hadoop streaming , Hadoop pipes , design of Hadoop distributed file system (HDFS) , HDFS concepts , Java interface , data flow ,Hadoop I/O , data integrity , oppression ,serialization , Avro file-based data structures

UNIT-IV **(8)**

Map reduce applications; Map Reduce workflows, UNIT tests with MR UNIT, test data and local tests – anatomy of Map Reduce job run , classic Map-reduce , YARN , failures in classic Map-reduce and YARN , job scheduling , shuffle and sort , task execution , MapReduce types , input formats , output formats

UNIT-V **(8)**

Hadoop related tools; HBase, data model and implementations, Hbase clients, Hbase examples – praxis. Cassandra, cassandra data model, cassandra examples ,cassandra clients , Hadoop integration.Pig , Grunt , pig data model , Pig Latin , developing and testing PigLatin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation – HiveQL queries

REFRENCES:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
3. Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. V.K. Jain, Big Data & Hadoop, Khanna Publishing House
5. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
7. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
8. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
9. Alan Gates, "Programming Pig", O'Reilley, 2011

Computer Graphics and Animation Lab (MCA-551)

Course Outcomes

1. Programming User-interface issues
2. Concepts of 2D & 3D object representation
3. Implementation of various scan & clipping algorithms 2D modeling
4. Implementation of illumination model for rendering 3D objects Visibility detection & 3D viewing
5. Implementation of a project based on learned concepts

LIST OF EXPERINETNS

(1) Digital differential Analyzer
(2) Line Drawing Algorithms
(3) Mid-point Circle Generation Algorithm
(4) Creating two-Dimensional Objects
(5) Two-dimensional Transformation
(6) Picture Coloring
(7) Three-Dimensional transformation
(8) Simple Animation using Transformation
(9) Key-Frame Animation
(10) Design Animation using FLASH

Note: Lab can be conducted in "C" language / Virtual Labs /Open GL.

Project Based on Software Engineering (MCA-552)

Course Outcomes

1. To prepare SRS document, design document, test, UML, DFD, ER diagrams
2. cases and software configuration management and risk management related document.
3. Develop function oriented and object oriented software design using tools like rational rose.
4. Able to perform unit testing and integration testing.
5. Apply various white box and black box testing techniques

Students are expected to analyse the problem Statement/ case study and design a solution applying software engineering principles.

Note: Lab can be conducted using Virtual Labs provided by IIT Khargpur/Bombay.

Colloquium (MCA-611)

Course Outcomes

1. Carry out a substantial research-based project
2. Demonstrate capability to improve student achievement, engagement and retention

3. Demonstrate capacity to lead and manage change through collaboration with others
4. Demonstrate an understanding of the ethical issues associated with practitioner research
5. Analyze data and synthesize research findings
6. Report research findings in written and verbal forms
7. Use research findings to advance education theory and practice.
8. Learn how to create unique, plagiarism free content and how to Publish work.

Industrial Project (MCA-612)

Course Outcomes

12. Learn to work in real practical software and industrial development environment where outer world find and access software services for their particular domain in various technologies.
13. Brush-up their knowledge complete in interested areas and software and web technologies.
14. Demonstrate a sound technical knowledge of their selected project topic.
15. Undertake problem identification, formulation and solution.
16. Design engineering solutions to complex problems utilising a systems approach.
17. Conduct an engineering project.
18. Communicate with engineers and the community at large in written an oral forms.
19. Demonstrate the knowledge, skills and attitudes of a professional engineer.
20. Learn to work in a team to accomplish the desired task in time bound and quality frame form.
21. Learn how to create report of project and presentation with professional required skill set.
22. Student learn Presentation Skills, Discussion Skills, Listening Skills, Argumentative Skills, Critical Thinking, Questioning, Interdisciplinary Inquiry, Engaging with Big Questions, Studying Major Works

RCA-E21: Cryptography and Network Security

UNIT-I **(8)**

Introduction: to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

UNIT-II **(8)**

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

UNIT-III **(8)**

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

UNIT-IV **(8)**

Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.

UNIT-V **(8)**

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET). System Security: Intruders, Viruses and related threads, firewall design principals, trusted systems.

REFRENCES

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Behrouz A. Frouzan: Cryptography and Network Security, Tata McGraw Hill
3. C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security, Wiley
4. Bruce Schiener, "Applied Cryptography". John Wiley & Sons
5. V.K. Jain, Cryptography and Network Security, Khanna Publishing House
6. Bernard Menezes," Network Security and Cryptography", Cengage Learning. 6. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill

RCA-E22 : Natural language Processing

UNIT-I **(8)**

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

UNIT-II **(8)**

Introduction to semantics and knowledge representation, some applications like machine translation, database interface.

UNIT-III **(8)**

Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT-IV **(8)**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

UNIT-V **(8)**

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

REFRENCES:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, NLP: A Paninian Perspective, Prentice Hall, New Delhi
2. James Allen, Natural Language Understanding, Pearson Education
3. D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education
4. L.M. Ivansca, S. C. Shapiro, Natural Language Processing and Language Representation
5. T. Winograd, Language as a Cognitive Process, Addison-Wesley

RCA-E23: Human Computer Interaction

UNIT-1 **(8)**

Introduction: Importance of user Interface – definition, importance of 8 good designs. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface

UNIT-II **(8)**

Design process – Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions.

UNIT-III **(8)**

Screen Designing : Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-IV **(8)**

Windows: New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT-V **(8)**

Software tools: Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

REFRENCES;

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human Computer Interaction, Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

RCA-E25: Modern Application Development

UNIT-I **(8)**

Introduction: Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT-II **(8)**

Basic design: Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT-III **98)**

Advanced design: Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT-IV **(8)**

Technology in android: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wi-fi – Integration with social media applications.

UNIT-V **(8)**

TECHNOLOGY II – IOS: Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace. Swift: Introduction to Swift features of swift.

REFRENCES:

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012
2. AnubhavPradhan , Anil V Despande Composing Mobile Apps,Learn ,explore,apply
3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS
6 Development: Exploring the iOS SDK”, Apress, 2013.

RCA-E32 Soft Computing

UNIT-I **(8)**

Artificial neural networks: Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self organizing networks - Hopfield network.

UNIT-II **(8)**

Fuzzy systems: Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition – Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

UNIT-III **(8)**

Neuro - fuzzy modeling: Adaptive networks based Fuzzy interface systems - Classification and Regression Trees – Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls – Simulated annealing – Evolutionary computation.

UNIT-IV **(8)**

Genetic algorithms: Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction – Rank method - Rank space method.

UNIT-V **(8)**

Application of soft computing: Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm-based Internet Search Techniques, Soft computing-based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.

REFRENCES:

1. Sivanandam, Deepa, " Principles of Soft Computing", Wiley
2. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill
4. Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall
5. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley
6. Wang, "Fuzzy Logic", Springer

RCA-E33 Information Storage Management

UNIT-I **(8)**

Introduction to Storage Technology: Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

UNIT-II **(8)**

Storage Systems Architecture; Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

UNIT-III **(8);**

Introduction to Networked Storage: JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options,
connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (SCSI, FCIP, FCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.

UNIT-IV **(8)**

Introduction to Information Availability: Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques.

UNIT-V **(8)**

Managing & Monitoring: Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

REFRENCES:

1. Information Storage and Management Storing, Managing, and Protecting Digital Information, by EMC, Hopkinton and Massachusetts, Wiley, **ISBN:** 97881265214
2. Information storage and management: storing, managing, and protecting digital information by Wiley Pub G Somasundaram, Alok Shrivastava
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002
4. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 2003.
5. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne. 2001.

RCA-E34 Digital Image Processing

UNIT-I **(8)**

Introduction and Fundamentals: Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Frequency Domain: Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Low pass Filters; Sharpening Frequency Domain Filters – Gaussian High pass Filters; Homomorphic Filtering.

UNIT-II **(8)**

Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

UNIT-III **(8)**

Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise Only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Band pass Filters; Minimum Mean-square Error Restoration.

UNIT-IV **(8)**

Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

UNIT-V **(8)**

Registration:

Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth

Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level thareholding, Local thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by thareholding, Edge Detector Performance, Line Detection, Corner Detection.

REFRENCES:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.
4. Digital Image Processing, Munesh C. Trivedi, Sanjay M. Shah, Khanna Publishing House

RCA-E35 Distributed Systems

UNIT–I **(8)**

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models.

Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks; Lamport's & vectors logical clocks.

Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.

UNIT-II **(8)**

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non-token-based algorithms, performance metric for distributed mutual exclusion algorithms.

Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.

UNIT–III **(8)**

Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory**.**

UNIT–IV **(8)**

Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems.

Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols.

UNIT–V **(8)**

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

REFRENCES:

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna,Gehrke," Database Management Systems", Mc Grawhill
3. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
4. Distributed System, Munesh C. Trivedi, Khanna Publishing House
5. Tenanuanbaum, Steen," Distributed Systems", PHI
6. Gerald Tel, "Distributed Algorithms", Cambridge University Press

RCA-E41 Distributed Database System

UNIT-I **(8)**

Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascade less schedules.

UNIT–II **(8)**

Lock based protocols, time stamp-based protocols, Multiple Granularity and Multi version Techniques, enforcing serializability by Locks, Locking system with multiple lock modes, architecture for Locking scheduler

UNIT-III **(8)**

Distributed Transactions Management, Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions, Moss Concurrency protocol.

UNIT–IV **(8)**

Issues of Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Log based recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and Inconsistent Messages.

UNIT-V **(8)**

Distributed Query Processing, Multiday Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques

REFRENCES:

1. Silberschatz, Korth and Sudershan, Database System Concept', Mc Graw Hill
2. Ramakrishna and Gehrke,' Database Management System, Mc Graw Hill
3. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education
4. Ceei and Pelagatti,'Distributed Database', TMH
5. Distributed System, Munesh C. Trivedi, Khanna Publishing House
6. Singhal and Shivratri, 'Advance Concepts in Operating Systems' MC Graw Hill

RCA-E42 Simulation and Modelling

UNIT-1 **(8)**

System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.

UNIT-II **(8)**

System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

UNIT-III **(8)**

Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

UNIT-IV **(8)**

System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams, Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

UNIT-V **(8)**

Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression-based languages, object-oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

REFRENCES:

1. Geoftrey Gordon, “System Simulation”, PHI
2. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, “Discrete Event System Simulation”, Pearson Education
3. V P Singh, “System Modeling and simulation”, New Age International.
4. Averill M. Law, W. David Kelton, “System Modeling and simulation and Analysis”, TMH

RCA-E43 Real Time Systems

UNIT-I **(8)**

Introduction: Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, precedence constraints and Data Dependency.

UNIT-II **(8)**

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III **(8)**

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-UNIT Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV **(8)**

Real Time Communication: Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols

UNIT-V **(8)**

Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

REFRENCES:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Mall Rajib, “Real Time Systems”, Pearson Education
3. Albert M. K. Cheng , “Real-Time Systems: Scheduling, Analysis, and Verification”, Wiley.

RCA-E44 Pattern Recognition

UNIT-1 **(8)**

Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

UNIT-II **(8)**

Statistical Patten Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions,

UNIT-III: **(8)**

Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

UNIT-IV: **(8)**

Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.

UNIT-V: **(8)**

Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partitioned clustering – K means, agglomerative hierarchical clustering, Cluster validation.

REFRENCES:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.
3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.