छत्रपति शाहू जी महाराज विश्वविद्यालय, कानपुर

CHHATRAPATI SHAHU JI MAHRAJ UNIVERSITY, KANPUR

(पूर्ववर्ती कानपुर विश्वविद्यालय कानपुर)

Formerly Kanpur University, Kanpur – 208024

A Documentary Support

For

Metric No. – 1.1.1

Programme Outcomes & Course Outcomes

Under the

Criteria - I

(Curriculum Design and Development)

Key Indicator - 1.1

In

Metric No. – 1.1.1

Master of Computer Application

Co-ordinator
Internal Quality Assurance Cell
CSJM University, Kanpur

(Registrar)
C.S.J.M.University
Kanpur

REGISTRAR
C.S.J.M. UNIVERSITY
KANPUR

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

SYLLABUS

(MCA)

COMPUTER APPLICATION

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

To provide affordable quality education at par with global

standards of academia and serve society with harmonious social diversity

To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem

To practice and encourage high standards of professional ethics and accountability among students

PO #	GA Theme	Detailed Statement of the PO
PO1	Computational Knowledge (**CK**)	Demonstrate competencies in fundamentals of computing, computing specialization, mathematics and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
PO2	Problem Analysis (**PA**)	Identify, formulate and analyze complex real-life problems in order to arrive at computationally viable conclusions using fundamentals of mathematics, computer sciences, management and relevant domain disciplines.
PO3	Design / Development of Solutions (**DDS**)	Design efficient solutions for complex, real-world problems to design systems, components or processes that meet the specifications with suitable consideration to public health, safety, cultural, societal and environmental considerations.
PO4	Conduct Investigations of Complex Computing Problems (**CICP**)	Ability to research, analyze and investigate complex computing problems through design of experiments, analysis and interpretation of data and synthesis of the information to arrive at valid conclusions.
PO5	Modern Tool Usage (**MTU**)	Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations

PO #	GA Theme	Detailed Statement of the PO
PO6	Professional Ethics (**PE**)	Ability to perform professional practices in an ethical way, keeping in the mind cyber regulations & laws, responsibilities and norms of professional computing practices.
PO7	Life-long Learning (**LLL**)	Ability to engage in independent learning for continuous self-development as a computing professional.
PO8	Project Management and Finance (**PMF**)	Ability to apply knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
PO9	Communication Efficacy (**CE**)	Ability to effectively communicate with the technical community and with the society at large about *complex* computing activities by being able to understand and write effective reports, design documentation, make effective presentations with the capability of giving and taking clear instructions.
PO10	Societal and Environmental Concern (**SEC**)	Ability to recognize and assess societal, environmental, health, safety, legal and cultural issues within local and global contexts and the consequential responsibilities applicable to professional computing practices.
PO11	Individual and Team Work (**I&T**)	Ability to work in multi-disciplinary team collaboration both as a member and leader, as per need.
PO12	Innovation and Entrepreneurship (**I&E**)	Ability to apply innovation to track a suitable opportunity to create value and wealth for the betterment of the individual and society at large.

 Regional Yellow  National Blue  Global Grey  Local Green

Program Specific Outcomes (PSOs)

PSO-1	To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions as per the local/regional/ national/ global requirements and availability of resources/ technologies.
PSO-2	To be able excel in contemporary technologies being adopted by the industry and academia for providing sustainable solutions
PSO-3	To be able to excel in various programming/project competitions and technological challenges laid by professional bodies

Programme Education Objectives (PEO):

It is envisioned that the graduates passing out MCA degree, will achieve the following objectives and accomplishments, in a span of 05 – 10 years time, after having passed the MCA degree:-

PEO	Detailed Statement of the PEO
PEO1	Exhibit professional competencies and knowledge for being a successful technocrat.
PEO2	Adopt creative and innovative practices to solve real-life complex problems.
PEO3	Be a lifelong learner and contribute effectively to the betterment of the society.
PEO4	Be effective and inspiring leader for fellow professionals and face the challenges of the rapidly changing multi-dimensional, contemporary world.

MCA (Master of ComputerApplications)

First Year

First Semester

Sr. No.	Code No.	Paper	Periods	Internal Assessment	ESE	Subject Total	Credits
	Theory Papers		**L T P**	**CT TA Total**			
1	MCA-1001	Fundamental of Computers & Emerging Technologies	3 1 0	30 20 50	100	150	4
2	MCA-1002	Problem Solving using C	3 1 0	30 20 50	100	150	4
3	MCA-1003	Principles of Management& Communication	3 1 0	30 20 50	100	150	4
4	MCA-1004	Discrete Mathematics	3 1 0	30 20 50	100	150	4
5	MCA-1005	Computer Organization & Architecture	3 1 0	30 20 50	100	150	4
	Practicals						
6	MCA-1051	Principles of ProgrammingUsing C Lab	0 0 3	30 20 50	50	100	3
7	MCA-1052	Professional CommunicationLab	0 0 2	30 20 50	50	100	2
	Total					**950**	**25**

Second Semester

Sr. No.	Code No.	Paper	Periods			Internal Assessment			ESE	Subject Total	Credits
	Theory Papers		**L**	**T**	**P**	**CT**	**TA**	**Total**			
1	MCA-2001	Theory of Automata & Formal Language	3	1	0	30	20	50	100	150	4
2	MCA-2002	Object Oriented Programming	3	1	0	30	20	50	100	150	4
3	MCA-2003	Operating Systems	3	1	0	30	20	50	100	150	4
4	MCA-2004	Database Management Systems	3	1	0	30	20	50	100	150	4
5	MCA-2005	Data Structures & Analysis of Algorithms	3	1	0	30	20	50	100	150	4
	Practicals										
6	MCA-2051	DBMS Lab	0	0	3	30	20	50	50	100	3
7	MCA-2052	Object oriented and data structure lab	0	0	3	30	20	50	50	100	3
	Total									**950**	**26**

MCA (Master of Computer Applications)

Second Year

Third Semester

Sr. No.	Code No.	Paper	Periods			Internal Assessment			ESE	Subject Total	Credits
	Theory Papers		**L**	**T**	**P**	**CT**	**TA**	**Total**			
1	MCA-3001	Computer Network	3	1	0	30	20	50	100	150	4
2	MCA-3002	Artificial Intelligence	3	1	0	30	20	50	100	150	4
3	MCA-3003	Software Engineering	3	1	0	30	20	50	100	150	4
4	MCA-3004	***Elective – I***	3	1	0	30	20	50	100	150	4
5	MCA-3005	***Elective – 2***	3	1	0	30	20	50	100	150	4
6	UHV-201	Universal Human Values	3	0	0	-	-	-	-	-	3
	Practicals										
6	MCA-3051	Software Engineering Lab	0	0	3	30	20	50	50	100	3
7	MCA-3052	Mini Project(AI / ISCL)						100	50	150	4
		Total								**1000**	**30**

Fourth Semester

Sr. No.	Code No.	Paper	Periods			Internal Assessment			ESE	Subject Total	Credits
	Theory Papers		**L**	**T**	**P**	**CT**	**TA**	**Total**			
1	MCA-4001	***Elective – 3***	3	1	0	30	20	50	100	150	4
2	MCA-4002	***Elective – 4***	3	1	0	30	20	50	100	150	4
3	MCA-4003	***Elective – 5***	3	1	0	30	20	50	100	150	4
6	MCA-4061	Major Project						350	150	500	15
		Total								**950**	**27**
									Total Credits		**108**

		ELECTIVE SUBJECTS
Elective-1	1	Cryptography & Network Security
	1	Data Warehousing & Data Mining
	1	Software Project Management
	1	Cloud Computing
Elective-2	2	Web Technology
	2	Big Data
	2	Software Testing & Quality Assurance
	2	Digital Image Processing
Elective-3	3	Privacy & Security in Online Social Media
	3	Soft Computing
	3	Pattern Recognition
	3	Software Quality Engineering
	3	Compiler Design
Elective-4	4	Block chain Architecture
	4	Neural Network
	4	Internet of Things
	4	Wireless and Mobile Computing
	4	Computer Vision
Elective-5	5	Mobile Computing
	5	Computer Graphics and Animation
	5	Natural Language Processing
	5	Machine Learning
	5	Quantum Computing

Syllabus

MCA 1st Year

1stSemester

MCA (MASTER OF COMPUTER APPLICATION)

FIRST YEAR – SYLLABUS

SEMESTER-I

MCA1001: FUNDAMENTAL OF COMPUTERS & EMERGING TECHNOLOGIES	
CO1	Demonstrate the knowledge of the basic structure, components, features and generations of computers.
CO2	Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.
CO3	Compare and contrast features, functioning & types of operating system and computer networks.
CO4	Demonstrate architecture, functioning & services of the Internet and basics of multimedia.
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Computer:** Definition, Computer Hardware & ComputerSoftware **Components:** Hardware – Introduction, Input devices, Output devices, Central Processing Unit,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 ofcommand based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Datacommunication, 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, SmartCities, Industrial Internet of Things.	**08**
IV	**Block chain:** Introduction, overview, features, limitations and application areasfundamentals of Block Chain. **Crypto currencies:** Introduction, Applications and use cases **Cloud Computing:** It nature and benefits, AWS, Google, Microsoft & IBMServices	**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.
2. Norton P., —Introduction to Computers‖, McGraw HillEducation.
3. Goel A., —Computer Fundamentals‖,Pearson.
4. BalagurusamyE.,—FundamentalsofComputers‖,McGrawHill
5. TharejaR., —FundamentalsofComputers‖,OxfordUniversityPress.
6. BindraJ.,—TheTechWhisperer-onDigitalTransformationandtheTechnologiesthatEnableit‖,Penguin

MCA1002 :PROBLEM SOLVING USING C		
CO1	Illustrate and explain the basic computer concepts and programming principles of C language.	
CO2	Develop C programs to solve simple mathematical and decision making problems.	
CO3	Develop C programs to solve simple engineering problems using looping constructs.	
CO4	Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.	
DETAILED SYLLABUS		**3-1-0**
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, GUIinteraction within the program.	**08**

Suggested Readings:

1. Kanetkar Y., —Let Us C‖, BPBPublications.
2. Hanly J. R. and Koffman E. B.,—Problem Solving and Program Design in C‖, Pearson Education.
3. Schildt H., —C- The Complete Reference‖,McGraw-Hill.
4. Goyal K. K. and Pandey H.M., Trouble Free C‖, University SciencePress
5. Gottfried B., —Schaum's Outlines- Programming in C‖, McGraw-HillPublications.
6. Kochan S.G., —Programming in C‖,Addison-Wesley.
7. Dey P. and Ghosh M., —Computer Fundamentals and Programming in C‖, Oxford UniversityPress.
8. Goyal K. K., Sharma M. K. and Thapliyal M. P. —Concept of Computer andC Programming‖, UniversityScience Press.

MCA1003 : Principles of Management & Communication		
CO1	Describe primary features, processes and principles of management.	
CO2	Explain functions of management in terms of planning, decision making and organizing.	
CO3	Illustrate key factors of leadership skill in directing and controlling business resources and processes.	
CO4	Exhibit adequate verbal and non-verbal communication skills	
CO5	Demonstrate effective discussion, presentation and writing skills.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Management**: Need, Scope, Meaning and Definition. The process of Management, Development of Management thought F.W. Taylor and HenryFayol, Horothorne Studies, Qualities of an Efficient Management.	**08**
II	**Planning & Organising:** Need, Scope and Importance of Planning, Steps inplanning, Decision making model. Organising need and Importance, Organisational Design,Organisational structure, centralisation and Decentralisation, Deligation.	**08**
III	**Directing & Controlling:** Motivation—Meaning, Importance, need.Theories ofMotivation,Leadership—meaning,needandimportance,leadershipstyle,Qualitiesof effective leader, principles of directing, Basic control process, Different control Techniques.	**08**
IV	**IntroductiontoCommunication:**WhatisCommunication,Levelsofcommunicatio n, 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 ofTechnicalcommunication.	**08**
V	**Business letters:** Sales & Credit letters; Claim and Adjustment Letters; Jobapplication 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.
2. C.B.Gupta,"ManagementPrinciplesandPractice",SultanChand&Sons3rd edition.
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,"TechnicalCommunicationPrinciplesandPractices",Oxford Univ. Press, 2007, NewDelhi.
7. KoontzHarold&WeihrichHeinz,"EssentialsofManagement",McGrawHill5th Edition2008.
8. RobbinsandCoulter,"Management",PrenticeHallof India,9th edition.
9. James A. F., Stoner, "Management", Pearson EducationDelhi.
10. P.D.Chaturvedi, "Business Communication", PearsonEducation.

MCA1004 : Discrete Mathematics		
CO1	Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions	
CO2	Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic	
CO3	Identify and prove properties of Algebraic Structures like Groups, Rings and Fields	
CO4	Formulate and solve recurrences and recursive functions	
CO5	Apply the concept of combinatorics to solve basic problems in discrete mathematics	
DETAILED SYLLABUS		**3-1-0**
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,Combinati on 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. **Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection	**08**
III	**Algebraic Structures:** Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group andProperties 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**
IV	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, StrongInduction 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**

V	**Graph theory:** Path, cycles, handshaking theorem, bipartite graphs, sub-graphs, graph isomorphism, operations on graphs, Eulerian graphs and Hamiltonian graphs, planar graphs, Euler formula, traveling salesman problem, shortest path algorithms. Euler tours, planar graphs, Euler's formula, applications of Kuratowski's theorem, graph coloring, chromatic polynomials, trees, weighted trees, shortest path algorithms, spanning trees. . .	**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,"DiscreteMathematicalStructurewithapplicationtoComputerScienc e", McGrawHill.

MCA1005 : COMPUTER ORGANIZATION & ARCHITECTURE		
CO1	Describe functional units of digital system and explain how arithmetic and logical operations are performed by computers.	
CO2	Describe the operations of control unit and write sequence of instructions for carrying out simple operation using various addressing modes.	
CO3	Design various types of memory and its organization.	
CO4	Describe the various modes in which IO devices communicate with CPU and memory.	
CO5	List the criteria for classification of parallel computer and describe various architectural schemes.	
DETAILED SYLLABUS		**3-1-0**
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 andmemory 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 horizontaland vertical microprogramming.	**08**
IV	**Memory:**Basicconceptandhierarchy,semiconductorRAMmemories,2D&2 1/2D memoryorganization.ROMmemories.Cachememories:conceptanddesigniss ues& 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, standardcommunication interfaces.	**08**

Suggested Readings:

1. JohnP.Hayes,"ComputerArchitectureandOrganization",McGrawHill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", PearsonEducation.
3. M. Morris Mano, "Computer System Architecture",PHI.
4. CarlHamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", McGraw-Hill.
5. BehroozParahami, —Computer Architecture‖, Oxford UniversityPress.
6. David A. Patterson and John L. Hennessy, —Computer Architecture-A Quantitative Approach‖,ElsevierPub.
7. Tannenbaum, "Structured Computer Organization",PHI.

Syllabus

MCA 1st Year

2ndSemester

MCA (MASTER OF COMPUTER APPLICATION)

FIRST YEAR SYLLABUS

SEMESTER-II

MCA2001: THEORY OF AUTOMATA & FORMAL LANGUAGES		
CO1	Define various types of automata for different classes of formal languages and explain their working.	
CO2	State and prove key properties of formal languages and automata.	
CO3	Construct appropriate formal notations (such as grammars and regular expressions) for given formal languages.	
CO4	Convert among equivalent notations for formal languages.	
CO5	Explain the significance of the Universal Turing machine, ChurchTuring thesis and concept of Undecidability.	
DETAILED SYLLABUS		**3-1-0**
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 andLanguage, Non Deterministic Finite Automaton (NFA), Equivalence ofDFA and NFA, NFA with ε-Transition, Equivalence of NFA's with andwithout ε-Transition, Finite Automata with output- Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine,Minimization of Finite Automata, Myhill-NerodeTheorem, Simulation ofDFA and NFA.	**08**
II	**RegularExpressionsandLanguages:**RegularExpressions,Transition Graph,Kleen'sTheorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages-Closure properties of RegularLanguages, Pigeonhole Principle, Pumping Lemma, Application of	**08**

	Pumping Lemma, Decidability- Decision properties, Finite Automataand Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	
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 NormalForm(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, ALanguage 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 TuringMachine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing MachineConstruction, 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, Languagesand Computation", Pearson EducationAsia,2ndEdition.
2. J. Martin, "Introduction to languages and the theory of computation", McGraw Hill,3rdEdition.
3. C. Papadimitrou and C. L. Lewis, "Elements and Theory of Computation",PHI.
4. K.L.P. Mishra and N.Chandrasekaran,"TheoryofComputer Science Automata Languagesand Computation" , PHI.
5. Y.N. Singh, "Mathematical Foundation of Computer Science", New Age International.

MCA2002 : OBJECT ORIENTED PROGRAMMING		
CO1	List the significance and key features of object oriented programming and modeling using UML	
CO2	Construct basic structural, behavioral and architectural models using object oriented software engineering approach.	
CO3	Integrate object oriented modeling techniques for analysis and design of a system.	
CO4	Use the basic features of data abstraction and encapsulation in C++ programs.	
CO5	Use the advanced features such as Inheritance, polymorphism and virtual function in C++ programs.	
DETAILED SYLLABUS		**3-1-0**
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, differences between classes and interfaces and extending interfaces, Object cloning, innerclasses. Packages: Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, Import and StaticImport Naming Convention ForPackages, Networking java.net package.	**08**
III	**Exception Handling, I/O**: Exceptions: exception hierarchy, throwing and catching exceptions,b uilt-inexceptions,creatingownexceptions,StackTraceElements.Input/ Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading andWritingFiles.	**08**

IV	**Multithreading and Generic Programming:** Differences between multithreading andmultitasking,threadlifecycle,creatingthreads,synchronizingthreads,Interthread communication, daemon threads, thread groups. Generic Programming: Genericclasses, generic methods, Bounded Types: Restrictions and Limitations.	**08**
V	**EventDrivenProgramming:**Graphicsprogramming:Frame,Components,w orking with 2D shapes, Using colors, fonts, and images. Basics of eventhandling:event handlers,adapterclasses,actions,mouseevents,AWTeventhierarchy.Introduc tionto 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.
4. BalagurusamyE,—ProgramminginJava‖,McGrawHill
5. Naughton,Schildt,—TheCompletereferencejava2‖,McGrawHill
6. Khalid Mughal, —A Programmer's Guide to Java SE 8 Oracle CertifiedAssociate (OCA)‖,Addison- Wesley.

MCA2003 : OPERATING SYSTEMS		
CO1	Explain main components, services, types and structure of Operating Systems.	
CO2	Apply the various algorithms and techniques to handle the various concurrency control issues.	
CO3	Compare and apply various CPU scheduling algorithms for process execution	
CO4	Identify occurrence of deadlock and describe ways to handle it.	
CO5	Explain and apply various memory, I/O and disk management techniques.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Operating System Structure- Layered structure, SystemComponents, Operating system functions, Classification of Operatingsystems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems,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 and Schemes,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, Avoidanceand detection, Recovery from deadlock.	**08**
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variablepartitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand	**08**

	paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	
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 and access 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.
2. Sibsankar Halder and Alex A Arvind, —Operating Systems‖, PearsonEducation.
3. Harvey M Dietel, —An Introduction to Operating System‖, PearsonEducation.
4. William Stallings, —Operating Systems: Internals and Design Principles‖, 6th Edition,PearsonEducation.
5. Harris, Schaum's Outline Of Operating Systems, McGrawHill

MCA2004 : DATABASE MANAGEMENT SYSTEMS		
CO1	Ability to understand the purpose and architecture of DBMSs.	
CO2	Ability to design of relational databases and writing SQL and PL/SQL statements to query relational databases.	
CO3	Ability to design and build ER models for sample databases.	
CO4	Ability to design and build a normalized database management system for real world databases.	
CO5	To understand the principles of transaction processing and concurrency control.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:**Overview,DatabaseSystemvsFileSystem,Database SystemCo ncept andArchitecture,DataModelSchemaandInstances,DataIndepen denceandDa tabase Language and Interfaces, Data Definitions Language, DML, OverallDatabase Structure. Data Modeling Using the Entity Relationship Model: ERModel 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, KeysConstraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. IntroductiontoSQL:CharacteristicsofSQL,AdvantageofSQL.SQLDataT ype and Literals.TypesofSQLCommands.SQLOperatorsandtheirProcedure .Tables, Views andIndexes.QueriesandSubQueries.AggregateFunctions.Insert,U pdateand Delete 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 SerializableSchedule, Recoverability, Recovery from Transaction Failures, Log BasedRecovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage,	**08**

	Concurrency Control, Directory System	
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniquesfor 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.
2. Date C J, —An Introduction to Database Systems‖, AddisionWesley.
3. Elmasri,Navathe,—FundamentalsofDatabaseSystems‖,AddisionWesley. 4. O'Neil, "Databases", ElsevierPub.
5. Ramakrishnan, "Database Management Systems", McGrawHill.
6. Leon &Leon,‖Database Management Systems‖, Vikas PublishingHouse.
7. BipinC.Desai,—AnIntroductiontoDatabaseSystems‖,GagotiaPublications.
8. Majumdar& Bhattacharya, —Database Management System‖, McGrawHill.

MCA2005: DATA STRUCTURES & ANALYSIS OF ALGORITHMS		
CO1	Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.	
CO2	Describe the applications of stacks and queues and implement various operations on them using arrays and linked lists.	
CO3	Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.	
CO4	Compare incremental and divide-and-conquer approaches of designing algorithms for problems such as sorting and searching.	
CO5	Apply and analyze various design approaches such as Divide-and-Conquer, greedy and dynamic for problem solving .	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type , Build in data type, Abstract datatype, 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 binarysearch, 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, Dequeueand Priority Queue. **Searching:** Concept of Searching, Sequential search, Index SequentialSearch, BinarySearch. Concept of Hashing & Collision resolution 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. GraphTraversal: Depth First Search and Breadth First Search, Connected Component.	**0 8**
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 BTree.	**0 8**
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, MatrixMultiplication: Strassen's Algorithm Dynamic Programming: Dijikstra Algorithm, Bellman Ford Algorithm, All-pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequenceGreedy Programming: Prims and Kruskal algorithm.	**0 8**

Suggested Readings:

1. Cormen T. H., Leiserson C. E., Rivest R. L., and Stein C.,—Introduction to Algorithms‖, PHI.
2. Horowitz Ellis, Sahni Sartaj and Rajasekharan S., —Fundamentals of Computer Algorithms‖, 2ndEdition, Universities Press.
3. DaveP.H.,H.B.Dave,—DesignandAnalysisofAlgorithms‖,2ndEdition,PearsonEducation.
4. Lipschuts S., —Theory and Problems of Data Structures‖, Schaum'sSeries.
5. Goyal K. K., Sharma Sandeep & Gupta Atul, —Data Structures and Analysis of Algorithms‖, HPHamilton.
6. Lipschutz,DataStructuresWithC-SIE-SOS,McGrawHill
7. SamantaD.,—ClassicDataStructures‖,2nd EditionPrenticeHallIndia.
8. Goodrich M. T. and Tomassia R., —Algorithm Design: Foundations, Analysis and Internetexamples‖, John Wiley andsons.
9. Sridhar S., —Design and Analysis of Algorithms‖, Oxford Univ.Press.
10. Aho, Ullman and Hopcroft, —Design and Analysis of algorithms‖, PearsonEducation.
11. R. Neapolitan and K. Naimipour, —Foundations of Algorithms‖,4th edition, Jones an BartlettStudentedition.
12. Reema Thareja, Data Structures using C, Oxford Univ.Press

Syllabus

MCA 2nd

Year3rd

Semester

MCA-3001:COMPUTER NETWORK		
CO1	Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.	
CO2	Apply knowledge of error detection, correction and learn concepts of flow control along with error control.	
CO3	Classify various IP addressing techniques, subnetting along with network routing protocols and algorithms.	
CO4	Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.	
CO5	Understand applications-layer protocols and elementary standards of cryptography and network security.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introductory Concepts: History, Goals and Applications of Networks, Layered Network Architecture, Review of ISO-OSI Model, Introduction to TCP/IP Model, Data Communication Techniques, Pulse Code Modulation (PCM), Multiplexing Techniques; Frequency Division, Time Division, Statistical Time Division Multiplexing. Physical Layer : Transmission Media: Wires, Cables, Radio Links, Satellite Link, Fiber Optic, Error Detection and Correction: Single and Burst Error, Parity Check Codes, Cyclic Redundancy Code & Hamming Code.	**10**
II	Data Link Layer Protocols: Stop and Wait Protocols: Noise free and Noisy channels, performance and efficiency, Sliding Window Protocols; Go Back n and Selective Repeat ARQS, performanceand efficiency.	**06**
III	Medium access sub layer: Channel allocations, LAN protocols, ALOHA Protocols Pure ALOHA, slotted ALOHA, Carrier Sense Multiple Access Protocols, CSMA with Collision Detection, Collision free Protocols, IEEE standards, FDDI, Data Link Layer elementary data link protocols, error handling, High Level Data Link Control, DQDB. HDLC data link protocols, ISDN, Channel Structure, Asynchronous Transfer Mode ATM.	**08**
IV	Network and Transport Layer Protocols: General Principles, Virtual Circuits and datagram's, Windows flow control, Packet Discarding, Traffic Shaping, Choke RSVP, Network Layer in ATM, Internet working using Bridge, Router and Gateways, Routing Algorithms: shortest path routing, Quality of Services, Primitives Connection Management: Addressing, Connection Establishment and Releases, Flow Control and Buffering, Crash recovery, Element of TCP/IP protocol: User Data gram Protocol, (UDP/TCP) Layering. TCP/IP packet, IP addresses, IPv6 Transport Layer: Design issues, connection management, TCP window Management, User Datagram Protocol, Transmission Control Protocol.	**10**

V	Application Layer: Network Security, DES, RSA algorithms, Domain Name System, Simple Network Management Protocol, Electronic mail, File Transfer Protocol, Hyper Text Transfer Protocol, Cryptography and compression Techniques.	**06**

Text Books and References:

1. A. S Tanenbaum, "Computer Networks, 3rd Edition", PHI
2. W. Stallings, "Data and Computer Communication", Macmillan Press
3. Comer, "Computer Networks & Internet", PHI.
4. Comer, "Internetworking with TCP/IP", PHI
5. Forouzan, "Data Communication and Networking", TMH

MCA-3002:ARTIFICIAL INTELLIGENCE		
CO 1	To introduce students to the basic concepts and principles of AI, including the history, applications and limitations of AI.	
CO 2	Identify the type of search strategy (heuristic) that is more appropriate to address a particular problem and implement the selected strategy. Design appropriate heuristics for a particular	
CO 3	Formalization of knowledge using the framework of predicate logic. Automatic reasoning in predicate logic using inference rules. Implementation of these reasoning systems using either	
CO 4	Introduce students to learning from observations and natural language processing. Game playing. Application of AI in different fields, environment etc.	
CO 5	To foster critical thinking skills in students with respect to ethical, social, and legal issues related to AI.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION: Definitions, Basic Elements of Artificial Intelligence, Artificial Intelligence application Areas, Intelligent Agents, Structure of Intelligent Agents, natural language, automatedreasoning, visual perception.	**10**
II	INTRODUCTION TO SEARCH: search knowledge, Problem solving: Solving problems by searching: state space formulation, depth first and breadth first search, iterative deepening production systems, search space control; depth-first, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, branch and bound, Problem Reduction, Constraint Satisfaction End and Means-End Analysis.	**10**
III	KNOWLEDGE REPRESENTATION AND REASONING: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM).	**10**
IV	NATURAL LANGUAGE PROCESSING: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing. Game Playing: Minimax, alpha-beta pruning Probabilistic reasoning systems, Bayesian networks. Learning from observations: Inductive learning, learning decision trees, computational learning theory, Explanation based learning. Applications: Environmental Science, Robotics, Aerospace, Medical Scioence etc.	**10**

Text Books and References:

6. E. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill.
7. E. Charnaik and D. McDermott," Introduction to artificial Intelligence", AddisonWesley Publishing Company.
8. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, PHI.
9. W.F. Clofisin and C.S. Mellish, “Programming in PROLOG”, Narosa Publishing Co.
10. Sanjiva Nath, “Turbo PROLOG”, Galgotia Publications Pvt. Ltd.
11. Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill
12. "AI: A modern approach" by Russel and Norvig, Pearson Education

MCA-3003:SOFTWARE ENGINEERING

At the end of course, the student will be able to understand

CO1	Explain various software characteristics and analyze different software Development Models.
CO2	Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards.
CO3	Compare and contrast various methods for software design.
CO4	Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing.
CO5	Manage software development process independently as well as in teams and make use of various software management tools for development, maintenance and analysis.

MCA-3003:SOFTWARE ENGINEERING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models, Overview of Quality Standards like ISO 9001, SEI – CMM. Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.	**10**
II	Software Project Planning Size Estimation like lines of Code & Function Count, Cost Estimation Models, Static single & Multivariable Models, COCOMO, COCOMO-II, Putnam resource allocation model, Risk Management. Software Design: Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.	**10**

III	Software Metrics: Software measurements: What & Why, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Regression Testing, Testing Tools & Standards.	**10**
IV	Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Calender time Component. Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.	**10**

Text Books and References:

13. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2001.
14. R. S. Pressman, "Software Engineering – A practitioner's approach", 5th Ed., McGraw Hill Int. Ed., 2001.
15. R. Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.
16. P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.
17. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996.
18. James Peter, W. Pedrycz, "Software Engineering", John Wiley & Sons., 1999
19. I. Sommerville, "Software Engineering", Addison. Wesley, 1999

MCA-3004:CRYPTOGRAPHY & NETWORK SECURITY		
At the end of course, the student will be able to understand		
CO1	Understand various security attacks and their protection mechanism.	
CO2	Apply and analyze various encryption algorithms.	
CO3	Understand functions and algorithms to authenticate messages and study and apply different digital signature techniques	
CO4	Analyze different types of key distributions.	
CO5	Study and appraise different IP and system security mechanism.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction and Mathematical Foundations: Introduction to group, field, finite,modular arithmetic, prime and relative prime numbers, Extended Euclidean algorithm, Modular Arithmetic, Overview on Modern Cryptography, Number Theory, probability and Information Theory. Introduction To Security: Attacks, Services & Mechanisms, Security, Attacks, Security Services. Classical Cryptosystems: Classical Cryptosystems. Symmetric Key Ciphers: Symmetric Key Ciphers, Modern Block Ciphers (DES), Modern Block Cipher (AES), Block Cipher Design Principles, Block Cipher Modes of Operation. Cryptanalysis of Symmetric Key Ciphers: Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers.	**10**
II	Conventional Encryption Algorithms: Triples DES, Blowfish, International Data encryption Algorithm, RCS, CAST-128, RC2 Placement & Encryption Function, Key Distribution, Random Number Generation, Placement Of Encryption Function. Public Key Encryption: Public-Key Cryptography: Principles Of Public-Key Cryptosystems, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange. Modern Trends in Asymmetric Key Cryptography.	**10**
III	Hash Functions: Message Authentication & Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Birthday Attacks, Security Of Hash Function & MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures: Digital Signatures, Authentication Protocol, Digital Signature Standard (DSS), Proof Of Digital Signature Algorithm.	**10**

IV	Network & System Security: Authentication Applications: Kerberos X.509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP), S / Mime, Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.	**10**

MCA-3005:DATA WAREHOUSING AND DATA MINING		
At the end of course, the student will be able to understand		
CO1	Explain the functionality of different data warehousing	
CO2	Explain strength and limitation of various data warehousing	
CO3	Analyzing and cleaning technique of data.	
CO4	Various algorithm of data mining.	
CO5	Application of data mining algorithm.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse, Characteristics of Data Warehouse; Functionality of Data Warehouse, Data Warehouse Architecture: Introductions, Components of Data warehouse Architecture; Advantages and Applications of Data Warehouse.	**10**
II	**Planning and Designing:** Data Warehouse Planning and Requirements: Planning Data Warehouse and Key Issues, Data Warehouse development Life Cycle, Dimensional Modeling: Data Warehouse Schemas; Star Schema, Inside Dimensional Table, Inside Fact Table, Snowflake Schema.	**08**
III	**Data Warehouse & OLAP:** Introduction to OLAP, Characteristics of OLAP, Steps in the OLAP Creation Process, OLAP Architectures; Types of OLAP: MOLAP, ROLAP, HOLAP; Advantages of OLAP; Metadata.	**08**
IV	**Introduction to Data Mining:** Scope of Data Mining, Predictive Modeling, Architecture for Data Mining, Data Mining Tools.	**07**
V	**Data Mining Techniques:** Data Mining Versus Database Management System, Data Mining Techniques:- Association rules, Classification, Regression, Clustering.	**07**

Text Books and References:

1. Alex Berson, Stephen J. Smith “Data Warehousing, Data-Mining & OLAP”, TMH

2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, “ Data Warehousing: Architecture andImplementation”, Pearson

3. I. Singh, Data Mining and Warehousing, Khanna Publishing House

MCA-3006:**SOFTWARE PROJECT MANAGEMENT**		
CO1	Identify project planning objectives, along with various cost/effort estimation models.	
CO2	Organize & schedule project activities to compute critical path for risk analysis	
CO3	Monitor and control project activities.	
CO4	Formulate testing objectives and test plan to ensure good software quality under SEICMM	
CO5	Configure changes and manage risks using project management tools.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction and Software Project Planning Fundamentals of Software Project Management, Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.	**07**
II	Project Organization and Scheduling Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.	**10**
III	Project Monitoring and Control Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews.	**08**
IV	Software Quality Assurance and Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities.	**08**
V	Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools.	**07**

Text Books and References:

1. Software Project Management, M. Cotterell, Tata McGraw-Hill Publication.

2. Information Technology Project Management, Kathy Schwalbe, Vikas Pub. House.

3. Software Project Management, S. A. Kelkar, PHI Publication.

MCA-3007:CLOUD COMPUTING		
CO1	Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.	
CO2	Develop the ability to understand and use the architecture to compute and storage cloud, service and models.	
CO3	Understand the application in cloud computing.	
CO4	Learn the key and enabling technologies that help in the development of cloud.	
CO5	Explain the core issues of cloud computing such as resource management and security.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Cloud Computing Overview Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.	**07**
II	Cloud Insights Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.	**10**
III	Cloud Architecture- Layers and Models Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.	**08**
IV	Cloud Security- Security Patterns for Cloud Computing,Trusted Platform, Geo-tagging,Cloud VM Platform Encryption,Trusted Cloud Resource Pools,Secure Cloud Interfaces,Cloud Resource Access Control,Cloud Data Breach Protection,Permanent Data Loss Protection.	**08**
V	Application Development: Service creation environments to develop cloud based applications, Development environments for service development; Amazon, Azure, Google App, Salesforce.com, IBM Cloud, Google MapReduce, Yahoo Hadoop.	**07**

Text Books and References:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter,TATA McGraw- Hill , NewDelhi – 2010
2. 2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - MichaelMiller - Que 2008
3. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc,2010
4. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, JohnWiley & Sons, Inc. 2011

MCA-3008:WEB TECHNOLOGIES		
CO1	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.	
CO2	Understand, analyze and apply the role of JavaScript in the workings of the web and web applications.	
CO3	Understand, analyze and build dynamic web applications using servlet and JSP.	
CO4	Develop Spring-based Java applications using Java configuration, XML configuration, annotation-based configuration, beans and their scopes, and properties.	
CO5	Develop web application using Spring Boot and RESTFul Web Services	
DETAILED SYLLABUS		**3-1-1**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.	**07**
II	HTML Common tags- List, Tables, images, forms, Frames; XML: Introduction to XML, Defining XMLtags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.	**10**
III	Java script: Introduction, documents, forms, statements, functions, objects, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects; introduction to AJAX, Simple AJAX applications	**08**
IV	Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3	**08**
V	Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0,Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing	**07**

	effective navigation	

Text Books and References:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill
3. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech
4. Java Server Pages – Hans Bergsten, SPD O'Reilly
5. Java Script, D.Flanagan, O'Reilly, SPD.
6. Beginning Web Programming-Jon Duckett WROX.
7. Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson.
8. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

MCA-3009:BIG DATA		
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		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Big Data:**Types of Digital Data, Characteristics of Data , Evolution of Big Data , Definition of Big Data , Challenges with Big Data , 5Vs of Big Data, Business Intelligence vs. Big Data. Big Data Analytics: Classification of analytics , Data Science , Terminologies in Big Data.	**05**
II	**Introduction to Hadoop:** Features , Advantages , Versions , Overview of Hadoop Eco systems ,Hadoop distributions , Hadoop vs. SQL , RDBMS vs. Hadoop , Hadoop Components.	**08**
III	**Hadoop Distributed File System:** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	**10**
IV	**Map Reduce:** Map Reduce Types and Formats, Map Reduce Features, Mapper, Reducer, Combiner , Partitioner , Searching , Sorting , Compression.	**07**
V	**Hadoop Eco systems:** Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Big SQL : Introduction	**10**

Text Books and References:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015.
2. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012.
4. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with AdvancedAnalytics”, John Wiley& sons, 2012.
5. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007

MCA-3010:SOFTWARE TESTING AND QUALITY ASSURANCE		
CO1	Test the software by applying testing techniques to deliver a product free from bugs.	
CO2	Investigate the scenario and select the proper testing technique.	
CO3	Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.	
CO4	Understand how to detect, classify, prevent and remove defects.	
CO5	Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	What is software testing and why it is so hard? Faults, Errors, and Failures, Basics of software testing, Testing objectives, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking. White Box and Black Box Testing White box testing, static testing, static analysis tools, Structural testing: Unit/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Differences between white box and Black box testing.	**07**
II	Requirements based testing, Boundary value analysis, Equivalence partitioning, state/graph based testing, Model based testing and model checking, Integration, System, and Acceptance Testing Top down and Bottom up integration, Bi-directional integration, System integration, Scenario Testing, Defect Bash, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing.	**10**
III	Software Verification and Validation**:** Introduction, Verification, Verification Workbench, Methods of Verification, Types of reviews , Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities.	**08**
IV	Software Quality**:** Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management	**08**

	System, and Important Aspects of Quality Management.	
V	Software Quality Assurance: Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches	**07**

Text Books and References:

1. Software Project Management, M. Cotterell, Tata McGraw-Hill Publication.
2. Information Technology Project Management, Kathy Schwalbe, Vikas Pub. House.
3. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.
4. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.

MCA-3011:**DIGITAL IMAGE PROSESSING**		
CO1	Explain the basic concepts of two-dimensional signal acquisition, sampling, quantization and color model.	
CO2	Apply image processing techniques for image enhancement in both the spatial and frequency domains.	
CO3	Apply and compare image restoration techniques in both spatial and frequency domain	
CO4	Compare edge based and region based segmentation algorithms for ROI extraction.	
CO5	Explain compression techniques and descriptors for image processing.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamentals:** Need for DIP- Fundamental steps in DIP – Elements of visual perception - Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization.	**06**
II	**Image Transforms:** Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT,Discrete cosine transform and KL transform.-Discrete Short time Fourier Transform- Wavelet Transform-Discrete wavelet Transform- and its application inCompression.	**06**
III	**Image Enhancement: Spatial Domain**: Basic relationship between pixels-Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. **Frequency Domain**: Smoothing frequency domain filters- sharpening frequency domain filters Homomorphic filtering.	**08**
IV	**Image Restoration:** Overview of Degradation models –Unconstrained and constrainedrestorations-Inverse Filtering ,WienerFilter.	**06**

V	**Feature Extraction:** Detection of discontinuities – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation- matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology – Boundary descriptors- Regional descriptors.	**07**
VI	**Image Reconstruction from Projections:** Need- Radon Transform – Back projection operator- Projection Theorem- Inverse Radon Transform.	**07**

Text Books and References:

1. Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education- 2/e – 2004.
2. Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education-2003.
3. B.Chanda & D.Dutta Majumder – Digital Image Processing and Analysis – Prentice Hall of India – 2002

UHV-201 Universal Human Values		
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc	
CO3	Understand the role of a human being in ensuring harmony in society and nature	
CO4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work	
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Value Education** Value Education, Definition, Concept and Need for Value Education.The Content and Process of Value Education Basic Guidelines for Value Education Self exploration as a means of Value Education Happiness and Prosperity as parts of Value Education	**06**
II	**Harmony in the Human Being** Human Being is more than just the Body Harmony of the Self ('I') with the Body Understanding Myself as Co-existence of the Self and the Body Understanding Needs of the Self and the needs of the Body Understanding the activities in the Self and the activities in the Body	**06**
III	**Harmony in the Family and Society and Harmony in the Nature** Family as a basic unit of Human Interaction and Values in Relationships The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love Comprehensive Human Goal: The Five Dimensions of Human Endeavour. Harmony in Nature: The Four Orders in Nature. The Holistic Perception of Harmony in Existence	**08**
IV	The Basics for Ethical Human Conduct Defects in Ethical Human Conduct Holistic Alternative and Universal Order Universal Human Order and Ethical Conduct Human Rights violation and Social Disparities	**06**

V	**Professional Ethics** Value based Life and Profession. Professional Ethics and Right Understanding Competence in Professional Ethics Issues in Professional Ethics – The Current Scenario Vision for Holistic Technologies, Production System and Management Models	**07**

Text and Reference Books:

1. R.R. Gaur., R, Sangal. G.P Bagaria., A Foundation Course in Value Education, Excel Books, (2009).
2. R.R. Gaur., R, Sangal. G.P Bagaria, Teachers Manual for A Foundation Course in Human Values and Professional Ethics Excel Books, (2009).
3. A.N. Tripathy, Human Values, New Age International Publishers, (2003)
4. A. Nagaraj, JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak, (1999)
5. M.K. Gandhi, My Experiemnts with Truth, Maple Classics (2011)
6. I.C. Sharma, Ethical Philosophy of India, Nagin & Co Julundhar
7. Cecile Andrews, – Slow is Beautiful (2006)

Syllabus

MCA 2nd

Year4th

Semester

MCA-4001:PRIVACY AND SECURITY IN ONLINE SOCIAL MEDIA		
CO1	Understand working of online social networks	
CO2	Describe privacy policies of online social media	
CO3	Analyse countermeasures to control information sharing in Online social networks.	
CO4	Apply knowledge of identity management in Online social networks	
CO5	Compare various privacy issues associated with popular social media.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Online Social Networks : definition, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs, Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology- Firewall and VPNs, Intrusion Detection, Access Control.	**10**
II	**A**ppreciate various privacy and security concerns (spam, phishing, fraud nodes, identity theft) on Online Social Media,Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.	**10**
III	Information privacy disclosure,revelation and its effects in OSM and online social networks. Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.	**10**
IV	Trust, credibility, and reputations in social systems.Collecting data from Online Social Media.Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature	**10**

Text Books and References:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, “Analysing Computer Security ”, Pearson Education India.

2. V.K. Pachghare, “Cryptography and information Security”, PHI Learning Private Limited, Delhi India.

3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,”Introduction to Information Security and Cyber Law”Willey Dreamtech Press.

4. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill.

5. CHANDER, HARISH,” Cyber Laws And It Protection ” , PHI Learning Private Limited ,Delhi ,India

MCA-4002:**SOFT COMPUTING**		
Course outcome (CO): At the end of the course, the student will be able to:		
CO1	Understand soft computing techniques.	
CO2	Soft Computing techniques role in problem solving.	
CO3	Conceptualize and parameterize various problems to be solved through basic soft computing techniques.	
CO4	Analyze and integrate various soft computing techniques.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	**12**
II	Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	**12**
III	Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks. Application of Fuzzy Logic: Medicine, Economics etc.	**10**
IV	Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA	**06**

Text Books and References:

1. "An Introduction to Neural Networks", Anderson J.A., PHI, 1999.
2. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
3. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI, 1995.
4. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.
5. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
6. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

MCA-4003:PATTERN RECOGNITION		
CO1	Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition.	
CO2	Analysis the Statistical Patten Recognition.	
CO3	Understanding the different Parameter estimation methods.	
CO4	Understanding the different Nonparametric Techniques.	
CO5	Understand and Make use of unsupervised learning and Clustering in Pattern recognition.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Probability and Statistics for Pattern Recognition:** Pattern recognition systems, design cycle, learning and adaptation. Case studies of Pattern recognition, Statistical and syntactic patternrecognition	**06**
II	**Bayesian decision theory & Optimal classifiers:** Classification problem, classification error, Bayes minimum error classifier, Bayes minimum risk classifier, discriminent functions and decision surfaces, discriminent functions and decision surfaces – multidimensional case for distributions	**08**
III	**Parametric and Non-parametric estimation :** Parametric estimation of probability density functions, non parametric estimation of probability density functions, Parzen windows, k-nearest neighbor classifier, implementation of Parzen windows for estimation	**09**
IV	**Linear Discriminent functions & classifiers:** Properties of linear classifiers, linearly separable training samples, perceptron criterion and algorithm, minimum squared error criterion, Support vector machines, Fisher's linear discriminant	**09**
V	**Unsupervised learning & Clustering:** Unsupervised learning & Clustering, Stages in clustering ,hierarchical clustering, partitional clustering, Expectation-maximization(EM) algorithm	**08**

Text Books and References:

1. ' Introduction to Pattern Recognition' – Theodoridis, Koutrombas, Academic Press,3 rd Edition

2. ' Pattern Classification' – R.O.Duda, P.E. Hart, G.G.Stork , John Wiley and sons, 2004

3. 'Pattern Recognition & Machine Learning' – C.M.Bishop, Springer, 2006

MCA-4004:SOFTWARE QUALITY ENGINEERING		
CO1	Understand basic concepts of Software Quality along with its documents and process	
CO2	Apply knowledge of Software Quality in various types of software	
CO3	Compare the various reliability models for different scenarios	
CO4	Illustrate the software Quality Planning and Assurance	
CO5	Make use of various testing techniques in software implementation	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction Defining Software Quality, 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 and References:

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

MCA-4005:**COMPILER DESIGN**		
CO1	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.	
CO2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.	
CO3	Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.	
CO4	Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.	
CO5	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Compiler Structure: Introduction to Compiler, Phases and passes, cross compiler, Bootstrapping. Programming Languages: High level languages, the lexical and syntactic structure of a language. Lexical Analysis: The role of Lexical Analyzer, A simple approach to the design of Lexical Analyzer, Finite state machines ,regular expressions and their applications to lexical analysis, Transition Diagrams, Implementation of Lexical Analyzer, Lexical Analyzer Generator: LEX, Capabilities of Lexical Analyzer.	**10**
II	The syntactic specification of programming languages: Context free grammars, derivation and parse trees, ambiguity, capabilities of CFG. Syntax Analyzer Generator: YACC Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Bottom–up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers.	**10**
III	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. Intermediate Code Generation: Different Intermediate forms: three address code, Quadruples & Triples. Syntax Directed translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postfix translation.	**10**
IV	Symbol Tables: Data structure for symbols tables, representing scope information. RunTime Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors, semantic errors. 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, Global Data-Flow analysis.	**10**

Text Books and References:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education.
2. V Raghvan, " Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

MCA-4006:**BLOCKCHAIN ARCHITECTURE**		
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		**3-1-0**
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 cryptoprimitives: 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) Capitalmarkets, (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**

Text Books and References:

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 IBMRedbooks course”, https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

MCA-4007: NEURAL NETWORKS		
CO 1	Understanding the basic concepts and principles of neural networks: Students should be able to describe the structure and functioning of neural networks, including the roles of neurons, layers, activation functions, and various learning rules.	
CO 2	Acquire the concept of single layer perceptron classifier, its model and features, use of single layer perceptron for linearly separable classification.	
CO 3	Acquire the concept of multilayer feed-forward networks. Using multilayer perceptron for linearly non-separable classification, various learning rules and learning factors.	
CO 4	Grasp the detailed knowledge of single layer feedback networks and applications on optimization problems.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamentals of ANN**: Biological neurons, Feedforward Networks, Feedback Networks, Neural processing, Supervised and unsupervised learning, **Neural Network Learning Rules-** Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule, Outstar Learning Rule.	**10**
II	**Single-Layer Perceptron Classifiers:** Classification Model, Features, Discriminant Functions, Linear Machine and Minimum Distance Classification, Nonparametric Training Concept, Single-Layer Continuous Perceptron Networks for Linearly Separable Classifications, Multicategory Single-Layer Perceptron Networks	**10**
III	**Multilayer Feedforward Networks:** Linearly Nonseparable Pattern Classification, Delta Learning Rule for Multiperceptron Layer, Generalized Delta Learning Rule, Feedforward Recall and Error Back- Propagation Training, Feedforward Recall, Error Back-Propagation Training, Multilayer Feedforward Networks as Universal Approximators. **Learning Factors-** Initial Weights, Cumulative Weight Adjustment versus, Incremental Updating, Steepness of the Activation Function, Learning Constant, Momentum Method, Network Architectures Versus Data Representation, Necessary Number of Hidden Neurons, **Classifying and Expert Layered Networks-** Character Recognition Application, Expert Systems Applications.	**10**
IV	**Single-Layer Feedback Networks: Basic Concepts of Dynamical Systems, Mathematical Foundations of Discrete-Time, Hopfield Networks,** Mathematical Foundations of Gradient-Type Hopfield Networks, Transient Response of Continuous-Time Networks, Relaxation Modelling in Single-Layer Feedback Networks, Example Solutions of Optimization Problems, Minimization of the Travelling Salesman Tour Length.	**10**

Text Books and References:

1. **Introduction to Artificial Neural Systems** - Jacek M. Zurada, ISBN 0-3 14-93391-3, West Publishing Company.
2. **Neural Networks- A Comprehensive Foundation** - Simon Haykin, 2nd Edition, ISBN 81-7808-300-0, PearsonEducation (Singapore) Pte. Ltd.
3. **Neural Networks: Methodology and Applications** - G´erard Dreyfus, ISBN-10 3-540-22980-9, Springer-Verlag.
4. **Elements of Artificial Neural Networks** - Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka, ISBN 0-262-13328-8

MCA-4008:INTERNET OF THINGS		
CO1	Understand the concept of IoT and its significance in the current technological landscape.	
CO2	Familiarize with the hardware and software components that comprise an IoT system.	
CO3	Get acquainted with various hardware platforms as Raspberry pi, NetArduino etc.	
CO4	Explore different communication protocols and networking technologies used in IoT	
CO5	Develop skills in programming with Ardunio to create and manage IoT applications.	
CO 6	Learn about emerging trends and applications of IoT in various industries and fields.	
CO 7	Understand ethical considerations in the development and use of IoT systems.	
DETAILED SYLLABUS		**3-1-0**
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 and References:

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

MCA-4009:WIRELESS AND MOBILE COMPUTING

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Demonstrate knowledge on : cellular concepts like frequency reuse, fading, equalization, CDMA.
CO2	Demonstrate knowledge hand-off and interface and apply the concept to calculate link budget using path loss model.
CO3	Demonstrate knowledge equalization and different diversity techniques.
CO4	Apply the concept of GSM in real time applications.
CO5	Compare different multiple access techniques in mobile communication.

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** History of wireless communication, Cellular Telephone system, Mobile & Wireless devices, GSM, CDMA standards, Mobile services.**Wireless Transmission:** Frequencies for radio Transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation.	**08**
II	**Modern Wireless Communication System:** 2G Cellular networks, 3G wireless networks, WLL, WLANs, Bluetooth & Personal Area Network. **The Cellular Concept:** Frequency Reuse, channel assignment strategies, Handoff strategies, Interference & system capacity, improving coverage & capacity.	**08**
III	**Mobile Radio Propagation:** (Large Scale Path Loss): Introduction to radio wave propagation, free space propagation model, Relating power to electric field, Three basic propagation mechanisms, Reflection, Ground reflection.	**08**
IV	**Small Scale Fading & Multipath:** Small scale multipath propagation, Impulse response model of amultipath channel, small scale multipath measurements, parameters of mobile multipath channels.	**08**
V	**Wireless Networking:** Introduction, Difference b/w fixed & wireless telephone networks, Development of Wireless Networking, Traffic Routing in wireless networks, CCS, ISDN. **Speech coding:** Introduction, characteristics of speech signals, Quantization Techniques, ADPCM, FrequencyDomain Coding of Speech, Vocoders.	**08**

Text Books and References:

1. Wireless Communication –Theodore . S. Rappaport(PHI 2002),2nd edition
2. Mobile Communication - Jochen Schiller, Adison Wisley, 2nd Edition 2003

MCA-4010:**COMPUTER VISION**		
CO1	Identify basic terminology, theories and models in the field of Computer Vision.	
CO2	Analyze different methods of Computer Vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.	
CO3	Use and apply appropriate image processing methods for image filtering, image restoration, image reconstruction, segmentation, classification and representation.	
CO4	Assess which methods to use for solving a given problem, and analyze the accuracy of the methods.	
CO5	Design of Computer Vision system for a specific problem.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Image Formation Models** Monocular imaging system, Orthographic & Perspective Projection ,Camera model and Camera calibration. Binocular imaging systems.	**08**
II	**Image Processing and Feature Extraction** Image representations (continuous and discrete), Edgedetection.	**08**
III	**Motion Estimation** Regularization theory, Optical computation, Stereo Vision, Motion estimation,Structure from motion.	**08**
IV	**Shape Representation and Segmentation** Deformable curves and surfaces, Snakes and active contours, Level set representations Fourier and wavelet descriptors, Medial representations, Multires solution analysis.	**08**
V	**Object recognition** Hough transforms and other simple object recognition methods, Shapecorrespondence and shape matching, Principal component analysis, Shape priors for recognition.	**08**

Text Books and References:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall,2003

2. Robot Vision, by B. K. P. Horn, McGraw-Hill.

3. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

MCA-4011:MOBILE **COMPUTING**		
CO1	Study and aware fundamentals of mobile computing.	
CO2	Study and analyze wireless networking protocols, applications and environment.	
CO3	Understand various data management issues in mobile computing.	
CO4	Analyze different type of security issues in mobile computing environment.	
CO5	Study, analyze, and evaluate various routing protocols used in mobile computing.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.	**06**
II	Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover – Security	**07**
III	Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.	**07**
IV	Overview of Android, Devices running android, Why Develop for Android, Features of android, Architecture of Android, Libraries, Software development kit. Designing the user interface - Introducing views and view groups, Introducing layouts, Creating new views, Creating and using Menus.	**10**
V	Accessing Telephony Hardware, Introducing Android Instant Messaging, GTalk Service : Using, binding & Making connection, Managing chat Sessions, Sending and receiving Data messages, Introducing SMS, Using, sending & Listening SMS Messages. Accessing Android Hardware - Audio, Video and Using the camera, Introducing Sensor Manager, Android Telephony, Using Bluetooth, Manage network and Wi-Fi connections.	**10**

Text Books and References:

1. Mobile Communications J. Schiller, Addition Wesley Publication
2. GSM System Engineering A.Mehrotra, Addition Wesley Publication
3. Professional Android™Application Development Wrox Publications, Reto Meier
4. Hello Android, Introducing Google's Mobile Development Platform, Ed- Burnette, Pragmatic Programmers,ISBN: 978-1-93435-61 7-3

MCA-4012:COMPUTER GRAPHICS AND ANIMATION		
CO1	Understand the graphics hardware used in field of computer graphics.	
CO2	Understand the concept of graphics primitives such as lines and circle based on different algorithms.	
CO3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	
CO4	Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.	
CO5	Perform the concept of multimedia and animation in real life.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Line generation: Points and Lines, Planes, Pixels and Frame buffers, vector and character generation. Graphics Primitives: Display devices, Primitive devices, Display File Structure, Display control text, Line-drawing Algorithms: DDA Algorithm Bresenham's line Algorithm, Circle-generating Algorithm: Bresenham's, Midpoint, Polygon Filling Algorithm.	**10**
II	2-D Viewing and Clipping: Point Clipping, Line Clipping, Cohen-Sutherland Line Clippings, Cyrus-Beck Line Clipping Algorithm, Polygon Clipping: Sutherland Hodgman Algorithm. Polygon: Polygon Representation, Entering polygons, Filling polygons. Segments: Segments table, Creating deleting and renaming segments, Visibility.	**10**
III	2-D and 3-D Transformations: Basic Transformations: Translation, Rotation, Scaling, Shear, Composite Transformations: Rotations about a point, Reflection about a line, Homogeneous Coordinate Systems, 3-D Transformations, 3-D geometry primitives, Viewing Transformation, Projections: Parallel Projection, Orthographic & Oblique Projections, Perspective Projections. Interaction: Hardware input devices handling algorithms, Event handling echoing, Interactive techniques.	**10**
IV	Hidden Line and Surface: Back face removal algorithms, hidden line methods. Rendering and Illumination: Introduction to curve and Surfaces generation, Bezier, Hermite and B-spline algorithms. Multimedia and Animation: Introduction and Types of Animation, Tools, Multimedia Applications, Concepts of Hypertext/Hypermedia, Images, Audio and Video, Multimedia Tools.	**10**

Text Books and References:

1.Foley - Computer Graphics Principles & Practice, 2nd ed. Pearson Education., 2000
2.Hearn & Baker - Computer Graphics C version, 2nd ed. Pearson Education., 1986
3.Roger and Adams - Mathematical Element for Computer Graphics, 2nd ed., Tata McGraw Hill, 1989
4.David F. Rogers, "Procedural Element for computer graphics", McGraw Hill Book Company, 1985.
5.Steven Harrington, "Computer Graphics", A Programming Approach, 2nd Edition

MCA-4013:NATURAL LANGUAGE PROCESSING		
CO1	Study and understand basic concepts, background and representations of natural language.	
CO2	Analyze various real-world applications of NLP.	
CO3	Apply different parsing techniques in NLP.	
CO4	Understand grammatical concepts and apply them in NLP.	
CO5	Apply various statistical and probabilistic grammar methods to handle and evaluate ambiguity.	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Natural Language Understanding,Linguistic Background: Outline of English SyntaxKnowledge Representation and Reasoning:** A Representation Based on FOPC	**10**
II	**Grammars and Parsing:** Grammars and Sentence Structure, What Makes a Good Grammar, A Top- Down parser, Bottom-Up Chart Parser, Transition Network Grammars, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Grammars and Logic Programming **Features and Augmented Grammars**: Feature Systems and Augmented Grammars, AugmentedTransition Networks	**10**
III	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomena inLanguage, Toward Efficient Parsing, Human Preferences in Parsing **Encoding Uncertainty:** Shift-Reduce Parsers, A Deterministic Parser, Techniques for EfficientEncoding of Ambiguity	**10**
IV	**Ambiguity Resolution:** Statistical Methods, Basic Probability Theory, Estimating Probabilities, Partof Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context Free Grammars **Semantics and Logical form**: Semantics and Logical form, Word senses and ambiguity, Encodingambiguity in the logical form, Verbs and states in logical Form, Thematic roles	**10**

Text Books and References:

1. **James Allen, Natural Language Understanding**
2. **Jurafsky & Martin – Speech & Language Processors (Pearson)**

MCA-4014:MACHINE LEARNING		
CO1	Select and implement machine learning techniques and computing environments that are suitable for the applications under consideration.	
CO2	Recognize and implement various ways of selecting suitable hypothesis and model parameters for different machine learning techniques.	
CO3	Understand the significance of cost function and regularization for different machine learning algorithms to generalize well to new examples.	
CO4	Understand and apply scaling up machine learning techniques and associated computing techniques and technologies	
CO5	Understand and apply scaling up machine learning techniques and associated computing techniques and technologies	
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION TO MACHINE LEARNING: Introduction, Examples of various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension.	**10**
II	SUPERVISED LEARNING ALGORITHMS Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression,Multiple Linear Regression, Logistic Regression.	**10**
III	ENSEMBLE LEARNING: Ensemble Learning Model Combination Schemes, Voting, Error-CorrectingOutput Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking	**10**
IV	UNSUPERVISED LEARNING Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis(PCA), Locally Linear Embedding (LLE), Factor Analysis	**10**

Text Books and References:

1. James Allen, Natural language understanding
2. Jurafsky & Martin – Speech & Language Processors (Pearson)

MCA-4015: QUANTUM COMPUTING		
CO1	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.	
CO2	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.	
CO3	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).	
CO4	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.	
CO5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.	
DETAILED SYLLABUS		**3,1,0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit,multiple qubits.	**07**
II	Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.	**08**
III	Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.	**07**
IV	Quantum Information and Cryptography: Comparison between classical and quantum informationtheory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.	**08**
V	Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.	**10**

Text Books and References:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.2002
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II:Basic Tools and Special Topics, World Scientific.2004
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms. 2000