

Evaluation Scheme for MCA 2 Years Course (2020-2021)

S.No.	Year	Semester	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits		
					L	T	P	Sessional		ESE		Total	
								CT	TA				Total
1	1st	1st Semester	MCA-011	Fundamental of Computers & Emerging Technologies	3	1	0					4	
2			MCA-012	Principles of Programming using C	3	1	0					4	
3			MCA-013	Management Information System	3	0	0					3	
4			MCA-014	E-commerce	3	0	0					3	
			MCA-015	Discrete Mathematics	3	1	0					4	
5			MCA-016	Computer Organization & Architecture	3	1	0					4	
5			MCA-017	Principles of Programming Using C Lab	0	0	2					2	
7			MCA-018	Fundamental of Computers Lab	0	0	2					2	
													<b>Total Credits</b>
1	1st	2nd Semester	MCA-021	Theory of Automata & Formal Language	3	1	0					4	
2			MCA-022	Object Oriented Programming with Java	3	1	0					4	
3			MCA-023	Operating Systems	3	1	0					4	
4			MCA-024	Database Management Systems	3	1	0					4	
5			MCA-025	Data Structures & Analysis of Algorithms	3	1	0					4	
7			MCA-026	Object Oriented Programming Lab	0	0	2					2	
8			MCA-027	DBMS Lab	0	0	2					2	
9			MCA-028	Data Structures & Analysis of Algorithms Lab	0	0	2					2	
											<b>Total Credits</b>	<b>26</b>	

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Evaluation Scheme for MCA 2 Years Course (2020-2021)

1	2 nd	3rd Semester	MCA-031	Computer Network	3	1	0							4
2			MCA-032	Cryptography & Network Security	3	1	0							4
3			MCA-033	Software Engineering	3	1	0							4
4			MCA-034	Web Technology	3	1	0							4
5			MCA-035	Digital Image Processing	3	1	0							4
6			MCA-036	Web Technology LAB	0	0	2							2
7			MCA-037	Digital Image Processing LAB	0	0	2							2
8			MCA-038	Mini Project	0	0	4							2
													<b>Total Credits</b>	<b>26</b>
1		4th Semester	MCA-041	<i>Elective - 1</i>	3	1	0							4
2	MCA-042		<i>Elective - 2</i>	3	1	0							4	
3	MCA-043		<i>Elective - 3</i>	3	1	0							4	
4	MCA-044		Major Project / Dissertation										14	
													<b>Total Credits</b>	<b>26</b>
		<b>Total Credits</b>										<b>Total Credits</b>	<b>104</b>	

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**ELECTIVE SUBJECTS**

	<b>PAPER CODE</b>	<b>ELECTIVE SUBJECTS</b>	
<b>Elective-1</b>	MCA-041-E1	Artificial Intelligence	
	MCA-041-E2	Soft Computing	
	MCA-041-E3	Pattern Recognition	
	MCA-041-E4	Natural Language Computing	
	MCA-041-E5	Machine Learning	
<b>Elective-2</b>	MCA-042-E1	Data Warehousing & Data Mining	
	MCA-042-E2	Cloud Computing	
	MCA-042-E3	Big Data Analytics	
	MCA-042-E4	Software Project Management	
	MCA-042-E5	Software Testing & Quality Assurance	
<b>Elective-3</b>	MCA-043-E1	Internet of Things	
	MCA-043-E2	Compiler Design	
	MCA-043-E3	Quantum Computing	
	MCA-043-E4	Client Server Computing	
	MCA-043-E5	Simulation & Modeling	

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**DETAILED SYLLABUS**  
**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER**

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-011</b>
<b>Paper Name</b>		<b>Fundamental of Computers &amp; Emerging Technologies</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S. No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction: Introduction to computer systems, uses, types. Data Representation: Number system and Coding Schemes(ASCII and UNICODE). Human Computer Interface: Relationship between Hardware and Software, Types of software, Operating system as user interface, utility programs. Role of Computers in: Business, Manufacturing, Mobile Computing, Public Sector, Media, Defense Services.	12
<b>Unit 2</b>	Online Data Capture Tools: Types of data capture form templates. Question Formats for data capture , Data form design ,Data form distribution techniques , Response management , Text Formatting using Word Processing tools, bibliography and references., Tables, Inserting Pictures and Video; Managing Mail Merge: including linking with Database; Printing documents Creating Business Documents using the above facilities. Data Presentation using Presentation tools. Creating Business Presentations using above facilities	12
<b>Unit 3</b>	Cloud Computing: Meaning, Features, & Service models – Infrastructure as a service, Advantages and disadvantages, Mobile Computing: Meaning, Business Applications of Mobile computing, Virtual reality & Augmented Reality : Meaning and applications , IOT - Internet of Things: Meaning & Application	12
<b>Unit 4</b>	Internet-role and importance, Web Server and Web clients like web browser or web app, IP addressing : Public Vs Private, Static Vs Dynamic, world wide web and related protocols, eLibrary, Google Scholar.	12
<b>Unit 5</b>	Range of application: Scientific, Business, educational, weather forecasting and remote sensing, planning, multilingual applications management information, decision support system inventory control, medical, industrial control, banks, railways, etc.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Introduction to Information Technology by ITL Education Solutions Limited, second edition.</li> <li>2) 'O' Level made simple "introduction to ICT resources" by Satish Jain, Shashank Jain, Shashi Singh &amp; M. Geetha Iyer, BPB publication.</li> <li>3) Computer Fundamentals fourth edition by Pradeep K. Sinha and Priti Sinha BPB publications</li> <li>4) Information Technology The breaking wave by Dennis Curtin Tata McGraw-hill edition</li> <li>5) Computer Fundamentals by A. Goel, Pearson Education, 2010.</li> <li>6) Introduction to Information Technology by P. Aksoy and L. DeNardis, Cengage Learning, 2006</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%	
<b>Paper Code</b>	MCA-012	
<b>Paper Name</b>	Principles of Programming using C	
<b>Contacts</b>	3L + 1T	
<b>Credits</b>	4	
S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction to programming – definitions and developing Algorithms and flowcharts for simple programs. Introduction to C Programming: Origin and history of c programming character set, Identifiers and keywords data types, constants, variables, operators, special operators, constants, Expressions, compound statements, structure of C program, Input and output function.	12
<b>Unit 2</b>	C Statements – selection statements – if nested if's, the if-else –if ladder the conditional expressions, switch statement nested switch statements, iteration statements – the for loop, for loop variations, the while loop, the do-while loop, declaring variable with in selection and iteration statements, jump statement, the return statement, the go to submit, break statement, exit ( ) function, the continue statement, expression statement. Block statements.	12
<b>Unit 3</b>	Arrays – Array what is an array? – Array Declaration, Array Initialization – Accessing individual elements of an array – Two Dimensional Arrays – Multi Dimensional Array, Passing an array element to a function – Rules of using an array. What are strings? String I/O, string Manipulation.	12
<b>Unit 4</b>	Functions – The General Form of a Function, Math functions, elements of function, function categories, types of functions, Function Arguments Call by value, Call by Reference, return statement. Uses of functions. C pre – processor, storage classes – Automatic – Register, Static and external. Pointers – definition, pointer variables, pointer expressions, arithmetic pointers, pointers and arrays, initializing pointers and functions and problems with pointers	12
<b>Unit 5</b>	Structures – definition, accessing structure members, structure assignments, array of structures, passing structures, structure pointers, uses of structures Unions – definitions, difference between structure and union, type def. Files – introduction to streams and files, basics of files – file pointer, opening and closing files, writing and reading character, file functions.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Kerlinghan &amp; Ritchie The C programming language (PHI Publication)</li> <li>2) Byron Gottorfried Schaum's outline of programming with C</li> <li>3) E. Balaguruswamy Programming in Ansi 'C' (Tata McGraw Hill)</li> <li>4) Kanetkar "Let Us C" / BPB Publications. (Tata McGraw Hill)</li> <li>5) R. Sethi, Programming Languages, Addison-Wesley, 1996.</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%	
<b>Paper Code</b>	<b>MCA-013</b>	
<b>Paper Name</b>	<b>Management Information System</b>	
<b>Contacts</b>	<b>3L</b>	
<b>Credits</b>	<b>3</b>	
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction to Management: The Management Processes: Planning, Organizing Leading and Controlling. Management Levels: Top, Middle and Bottom. The Management School: Scientific Management, Classical Management, Behavioral Management, Management Science, Systems Approach, Contingency Approach.	12
<b>Unit 2</b>	Management in 21 <sup>st</sup> Century: Seven S Model, Organization Structure, Communication Processes. Strategy: Institutional, Operational, Total Quality Control (TQC), Total Quality Management (TQM), Electronic Data Interchange (EDI), Just- In-Time (JIT) Approach.	12
<b>Unit 3</b>	Applications of Management Information System: Types of Information System in Organizations: Transaction Processing System (TPS), Office System, Knowledge Work System (KWS), Decision Support System (DSS), Management Information System (MIS), Executive Support system (ESS).	12
<b>Unit 4</b>	E- Commerce: Overview of E-Commerce, Benefits of E- Commerce, Impact of E-Commerce, Applications of E-Commerce, Business Models of E-Commerce.	12
<b>Unit 5</b>	Electronic Payment System: Introduction to Payment System, Online Payment System. Pre-paid and Post-paid Payment System. Security in E-Commerce: Transaction Security, Cryptology, Authentication Protocol, Digital Signature.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Kenneth C. Laudon, Jane P. Laudon: Management Information System, Latest Edition, Pearson Education Publication.</li> <li>2) P.T. Josept: E-Commerce- A Managerial Perspective, PHI Publication.</li> <li>3) Jeffery: Introduction to E- Commerce, TMH.</li> <li>4) Any other Book(s) covering the contents of the paper in more depth.</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%	
<b>Paper Code</b>	MCA-014	
<b>Paper Name</b>	E-commerce	
<b>Contacts</b>	3L	
<b>Credits</b>	3	
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction to Electronic Commerce – E-Commerce Framework- Anatomy of E-Commerce Applications – E-Commerce Consumer & Organization Applications- E-Commerce and World Wide Web – Internet Service Providers – Architectural Framework for Electronic Commerce – WWW as the Architecture- Hypertext publishing.	12
<b>Unit 2</b>	Electronic Payment Systems – Types of Electronic Payment Systems – Digital Token Based Electronic Payment System – Smart Cards – Credit Cards – Risk in Electronic Payment Systems – Designing Electronic Payment Systems	12
<b>Unit 3</b>	Electronic Data Interchange, EDI Applications in Business, EDI implementation, MIME, and value added networks Work flow automation and Coordination, Customization and Internal Commerce, Supply Chain Management (SCM).	12
<b>Unit 4</b>	Corporate Digital Library – Document Library, Digital Document Types, Corporate Data Warehouse, Advertising and Marketing – Information based Marketing, Advertising on Internet, On-Line Marketing Process, Market Research.	12
<b>Unit 5</b>	Consumer Search and Resource Discovery – Information Search and Retrieval, Commerce Catalogues, Information Filtering Multimedia – Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Ravi Kalakota &amp; A. B. Whinston - "Frontiers of Electronic Commerce", Pearson Education, India, 1999.</li> <li>2) Daniel Minoli, Emma Minoli: "Web Commerce Technology Handbook", Tata McGraw Hill</li> <li>3) Bajaj and Nag. "E-Commerce the cutting edge of Business". TMH.</li> <li>4) E-Business &amp; Commerce: Brahm Cazner, Wiley dreamtech.</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%	
<b>Paper Code</b>	<b>MCA-015</b>	
<b>Paper Name</b>	<b>Discrete Mathematics</b>	
<b>Contacts</b>	<b>3L + 1T</b>	
<b>Credits</b>	<b>4</b>	
<b>S. No</b>	<b>Topic</b>	<b>No. of Lectures (Approx.)</b>
<b>Unit1</b>	Propositional functions, Quantifiers, Connectives, Boolean Algebra, Application to switching circuits, Reflexivity, Symmetry and Transitivity Equivalence Relations, Logical, Form and Logical Equivalence, Types of sentences, Truth Values and Truth Tables, Duality.	12
<b>Unit2</b>	Basic Definition of Set Theory, Properties of Sets, Empty Set, Partitions, Power Sets, Definitions of Boolean Algebra, Sub-Boolean Algebra, Ideals of Boolean Algebra, Boolean Functions, Normal Boolean Function, Disjunctive Normal Form, Conjunctive Normal Form, Representation of a Finite Boolean Algebra, Application of Switching Circuit.	12
<b>Unit3</b>	Introduction, Ordered Pair, Cartesian Product of Two sets, Relation, Inverse of a Relation, Classification of relations, Equivalence Relations, Composition of relation, Relations other than Equivalence, Functions, Types of Functions, Algebra of functions, Composition of functions, Binary Operations, Properties of Binary Operations.	12
<b>Unit4</b>	Basic Concept of Graphs and trees, Adjacency and Incidence Matrices, Spanning Tree, Transitive closure, Shortest Path, Planar Graphs, Graph, Matrix Representations of Graphs.	12
<b>Unit5</b>	Coloring, Applications of Graph Theoretic concepts to Computer Science. Introduction to Mathematical Logic. Counting and Probability, Possibility Trees and Multiplication Rule.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) J.P. Tremble and R.P. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill.</li> <li>2) Dornhoff and Hohn, Applied Modern Algebra, McMillan.</li> <li>3) N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI.</li> <li>4) R. Johnsonbaugh, Discrete Mathematics, Pearson Education, 2001.</li> <li>5) R.P. Garibaldi, Discrete and Combinatorial Mathematics, Pearson Education, 1999.</li> <li>6) C.L. Liu, Elements of Discrete Mathematics', McGraw Hill, 1985</li> <li>7) K.H. Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill, 2003</li> </ol>		

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-016</b>
<b>Paper Name</b>		<b>Computer Organization &amp; Architecture</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	STRUCTURE OF COMPUTERS: Computer types, Functional units, Basic operational concepts, Von Neumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes. COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.	12
<b>Unit 2</b>	BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC	12
<b>Unit 3</b>	REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit. MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.	12
<b>Unit 4</b>	MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.	12
<b>Unit 5</b>	INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA. MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.</li> <li>2) Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.</li> <li>3) William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersey.</li> <li>4) Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,</li> <li>5) John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill</li> </ol>		

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**DETAILED SYLLABUS**  
**1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER**

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-021</b>
<b>Paper Name</b>	<b>Theory of Automata &amp; Formal Language</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem	12
<b>Unit 2</b>	Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA	12
<b>Unit 3</b>	Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	12
<b>Unit 4</b>	Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA	12
<b>Unit 5</b>	Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undesirability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory	12

**Suggested Books:**

- 1) Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
- 2) K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.
- 3) Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
- 4) Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.
- 5) Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI Learning Private Limited, Delhi India.
- 6) K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
- 7) Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd.
- 8) Micheal Sipser, "Introduction of the Theory and Computation", Thomson Learning.

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%	
<b>Paper Code</b>	<b>MCA-022</b>	
<b>Paper Name</b>	<b>Object Oriented Programming with Java</b>	
<b>Contacts</b>	<b>3L + 1T</b>	
<b>Credits</b>	<b>4</b>	
<b>S. No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, Polymorphism, generosity, importance of modeling, principles of modeling, object oriented modeling, Introduction to UML, conceptual model of the UML, Architecture.	12
<b>Unit 2</b>	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for class & object Diagrams. Use cases, Use case Diagrams, Activity Diagrams, State Machine, Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram.	12
<b>Unit 3</b>	Object Oriented Analysis, Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Structured analysis and structured design (SA/SD), Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large.	12
<b>Unit 4</b>	Introduction to Java, History, Features, Object Oriented concept of Java, Classes and Objects, Inheritance, Packages, Interface, abstract method and classes, Polymorphism, Inner classes, String Handling, I/O, Networking, Event Handling. Multi-threading, Collection, Java APIs, The Java Beans API, Session Beans, Entity Beans, Introduction to Enterprise Java beans (EJB).	12
<b>Unit 5</b>	Java Swing: Introduction to AWT, AWT v/s Swing, Creating a Swing Applet and Application. Utility of Java as internet programming language, JDBC, The connectivity model, JDBC/ODBC Bridge, Introduction to servlets.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI</li> <li>2) Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education</li> <li>3) Naughton, Schildt, "The Complete Reference JAVA2"</li> <li>4) Sachin Malhotra &amp; Saurabh Chaudhary, Programming in Java Oxford University Press.</li> <li>5) Daniel Liang, Introduction to Java Programming, Pearson, Seventh Edition.</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-023</b>
<b>Paper Name</b>	<b>Operating System</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Importance of OS, Basic concepts and terminology, types of OS, Goals of OS, functions and characteristics of OS, historical evolution of operating system. User-System interface. System call interface.	12
<b>Unit 2</b>	Process: Concept and views, process control block, process life cycle, inter-process communication. CPU scheduling: Scheduling concept, scheduling criteria, scheduling algorithms; Interposes communication and synchronization, mutual exclusion, hardware support for mutual exclusion, critical region, solutions with busy waiting, semaphores, monitors, message passing, classical problems of IPC; Deadlocks: Deadlock Characterization, Deadlock prevention and avoidance, deadlock detection and recovery.	12
<b>Unit 3</b>	Resource manager, file management, processor management, device management, Memory management – contiguous memory allocation, paging, swapping, page replacement algorithm, virtual memory.	12
<b>Unit 4</b>	File management: File concept, file access and allocation methods, directory System, and file protection mechanisms, free space management, recovery. Disk management: Disk structure, disk attachment, disk scheduling algorithms, disk management, swap space concept and management, RAID structure.	12
<b>Unit 5</b>	Multiprocessor system, classification and types, introduction to parallel computing. Distributes OS- rationales, algorithms for distributed processing.	12

**Suggested Books:**

- 1) Operating Systems, Galvin & Silverschatz, John Wiley
- 2) Operating Systems, Milenkovic, TMH
- 3) Systems Programming & Operation Systems, Dhamdhere, TMH
- 4) Milan Milankovic, "Operating Systems, Concepts and Design", McGraw-Hill.
- 5) Harvey M Deital, "Operating Systems", Addison Wesley
- 6) Richard Peterson, "Linux: The Complete Reference", Osborne McGraw-Hill.
- 7) A.M. Lister, Fundamentals of Operating System. Macmillan
- 8) Douglas Cmer, Operating System Design- The XINU Approach. Prentice – Hall
- 9) Pramod Chandra P. Bhatt.- " An Introduction of Operating Systems, Concepts and Practice, PHI.

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-024</b>
<b>Paper Name</b>		<b>Database Management System</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Database Management System, Database System Application, Database System Vs File System, View of Data, Data Models Database Language, Database Users And Administrators, Transaction Management, Database System Structure, Application Architecture, History Of Database System	12
<b>Unit 2</b>	Entity Relationship model, Basic Concepts, Constraints, Keys, Design Issues, E-R Diagram, Weak Entity Sets, Extended E-R Features, Design Of E-R Database Scheme	12
<b>Unit 3</b>	SQL, Basic Structure, Set Operation, Aggregate Functions, Null Values, Nested Sub queries, Views, Complex Queries, Modification of Database, Joined Relations, DDL, Embedded SQL, User interfaces And Tools, Integrity And Security Constraints, Referential Integrity, Assertions, Security And Authorization, Authorization In SQL, Normalization	12
<b>Unit 4</b>	Transactions, Transaction Concepts, Transaction State, Implementation Of Atomicity And Durability, Concurrent Executions, Serilizability, Recoverability, Implementation of Isolation, Transaction Definition In Sql	12
<b>Unit 5</b>	Concurrency Control, lock-based protocols, timestamp-based protocols, validation based protocols, multiple granularity, deadlock handling, insert delete operation, weak level of consistency	12
<b>Suggested Book:</b>		
<ol style="list-style-type: none"> <li>1) Database system by Korth TMH</li> <li>2) Fundamentals of Database Systems by Navathe</li> <li>3) Silberschatz, orth and Sudershan, Database System Concept', Mc Graw Hill</li> <li>4) Ramakrishna and Gehrke,' Database Management System, Mc Graw Hill</li> <li>5) Date C.J., "An Introduction to Database Systems", Addison Wesley Leon &amp; Leon,"Database Management Systems", Vikas Publishing House</li> <li>6) Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications Majumdar &amp; Bhattacharya, "Database Management System", TMH</li> </ol>		

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-025</b>
<b>Paper Name</b>		<b>Data Structures &amp; Analysis of Algorithms</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Algorithm concept, Complexity-Big O- Notation, time space trade-off. Array-Row/Column major representation, sparse matrix. Linked List-Singly, circular, doubly. Stack-Push, Pop, Conversion from infix-to postfix, evaluation of postfix expression. Stack representation using array & linked list.	12
<b>Unit 2</b>	Queue- insert, delete, representation using array & linked list, circular queue (operation), dequeue (operation), priority queue and its operations.	12
<b>Unit 3</b>	Tree-definition-traversal algorithms (pre, post, in), BFS, DFS.Binary Tree, Complete Binary Tree, Binary search tree, AVL tree, B-tree, Heap, Huffman algorithm. Sorting with complexity analysis – bubble, merge, quick, selection, insertion, shell, tournament, radix and heap. Search-Linear & Binary. Recursion Technique	12
<b>Unit 4</b>	Notion of Algorithm, Growth of functions, Recurrences: The substitution method, The iteration method, Asymptotic Notations and Basic Efficiency Classes. Use of Big O , $\theta$ , $\Omega$ in analysis. Greedy Techniques, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's and Bellman Ford Algorithm, Huffman trees. Knapsack Problem.	12
<b>Unit 5</b>	Dynamic Programming Paradigm, Warshall's and Floyd's Algorithm, Optimal Binary Search trees, Matrix chain multiplication Problem, 0/1 Knapsack Problem, maximum network flow problem, naïve sting matching algorithm, string matching with finite automata Knuth Morris Pratt algorithm, The Rabin-Karp Algorithm.	12

**Suggested Books:**

- 1) Data Structure Using C & C++, Tannenbaum, PHI
- 2) Data Structures, Radhakrishnan & Shrinivasan, ISTE/EXCEL
- 3) C and Data Structures, Radhakrishnan Scitech
- 4) Data Structures & Program Design in C, 2<sup>nd</sup> Ed, Kruse, Tondo & Leung, PHI
- 5) Mastering Algorithms With C, Loudan, SPD/O REILLY
- 6) Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson Edition,-2006
- 7) Richard Neapolitan and Kumarss Naimipour, Foundations of Algorithms", Jones & Bartlett, 2004.
- 8) T.H. Cormen, C.E. Leiserson, R.L. Rivets and C. Stein, "Introduction to Algorithms" PHI, 3<sup>rd</sup> Ed., 2009

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**DETAILED SYLLABUS**  
**2<sup>ND</sup> YEAR 3<sup>RD</sup> SEMESTER**

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-031</b>
<b>Paper Name</b>		<b>Computer Network</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S. No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction to computer network- Topology, Guided & Unguided Media. Overview of Data & Signal Bits. Baud & Bit Rate. Modulation (AM, PM, FM); Multiplexing (TDM, FDM, WDM), Encoding (RZ, NRZ, BIPLOAR, MANCHESTER, DIFF. MANCHESTER). Digital To Analog-ASK, PSK, FSK.	12
<b>Unit 2</b>	Transmission methods- Synchronous & Asynchronous. OSI Model, TCP/IP Model. TCP/IP Frame Format, TCP and UDP.Bit oriented (BSC) & Character oriented Protocol (SDLC, LAPB, LAPD, and LLC), HDLC-frame format, and station, states, configuration, and access control. LAN Topology – Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), Token Ring (IEEE 802.5)	12
<b>Unit 3</b>	Flow Control, Error Control, Error Detection Methods- types of error, redundancy, forward error correction and retransmission, hamming distance, CRC, polynomials, checksum. Data link control: framing, flow and error control, simplest protocol, stop-and-wait protocol, stop-and-wait ARQ, go-back-n ARQ, selective repeat ARQ, piggybacking. Multiple access: CSMA, CSMA/CD, CSMA/CA.	12
<b>Unit 4</b>	Introduction to WAN – DQDB (IEEE 802.6) & FDDI. Switching Technologies- Circuit, Message, and Packet. Virtual-circuit networks. Internet protocol version 4, address mapping, delivery, forwarding and routing of IP packets. Unicast routing protocols: distance routing protocol, link state routing, OSPF, RIP, GBP.	12
<b>Unit 5</b>	Data traffic, congestion and congestion control. Congestion control in TCP. Quality of Service and techniques to improve it. Domain Name System (DNS). Telnet, FTP, WWW and HTTP. Introduction to Cryptography. Network Security: message confidentiality, message integrity, message authentication, message non-repudiation and entity authentication.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Data Communication &amp; Networking, Forouzan, TMH</li> <li>2) Computer Networks, Tannenbaum, PHI</li> <li>3) Data &amp; Computer Communications, Stallings, PHI</li> <li>4) Communication Networks, Walrand, TMH</li> <li>5) Computer Communication Networks, Shanmugam &amp; Rajeev, ISTE/EXCEL</li> <li>6) Data Communications, Prakash C. Gupta PHI</li> </ol>		

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA- 032</b>
<b>Paper Name</b>		<b>Cryptography and Network Security</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	The Security Problem in Computing: The meaning of Computer Security, Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography .FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic- Euclid’s algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat’s and Euler’s theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms	12
<b>Unit 2</b>	Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of publickey cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography	12
<b>Unit 3</b>	Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – ElGamal – Schnorr.	12
<b>Unit 4</b>	Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for Ecommerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	12
<b>Unit 5</b>	E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPsec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET)	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) William Stallings, Cryptography and Network Security, 6 th Edition, Pearson Education, March 2013.</li> <li>2) Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002.</li> <li>3) Behrouz A. Ferouzan, “Cryptography &amp; Network Security” Tata Mc Graw Hill, 2007</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA- 033
<b>Paper Name</b>	Software Engineering
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction to Software Engineering, Definition, Characteristics of A Software, Mc Call's Quality Factors. Software Development process, SDLC, Waterfall Model, Spiral Model, prototyping approach, 4GL approach, Requirement Analysis, Definition of System Analysis Role of system analyst, Requirement anticipation, investigation and specification, Feasibility study, Fact finding techniques-interview, questionnaire, record, review, observation.	12
<b>Unit 2</b>	Analysis and design tools, E-R analysis, Decision tree and decision tables, DFD (physical and logical), Data dictionary-definition, component, advantages Input and output design, Case studies, System design, Qualities of good design	12
<b>Unit 3</b>	System testing, Testing and debugging definition, Testing objectives and principles, Performance testing, User acceptance techniques, Stress testing, Test data generators.	12
<b>Unit 4</b>	System maintenance, Importance of maintenance, Software maintenance, Types of maintenance, Maintenance side effects, Reverse engineering, Re-engineering, Concept of software management, The software crisis, Principles of software engineering, Programming in small vs. programming in large, Software measurement.	12
<b>Unit 5</b>	Project management, relationship of life cycle, project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance, Metrics.	12

**Suggested Books:**

- 1) Software Engineering-Pressman
- 2) Analysis and Design of Information System-James Seann
- 3) System Analysis and Design-Parthsarthy-Khalkar
- 4) Rajib Mall, "Fundamentals of Software Engineering"
- 5) Pankaj Jalote, "Software Engineering", PHI.
- 6) Mishra, Mohanti, "Software Engineering", Pearson
- 7) Ian Sommerville, "Software Engineering", Addison Wesley

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-034</b>
<b>Paper Name</b>	<b>Web Technology</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction to WWW : Internet Standards, Introduction to WWW, WWW Architecture, SMTP, POP3, File Transfer Protocol, Overview of HTTP, HTTP request and response, Generation of dynamic web pages. Markup Language (HTML): Introduction to HTML and HTML , Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms.	12
<b>Unit 2</b>	Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, Manipulating text, Margins and Padding, Positioning using CSS. JavaScript Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations	12
<b>Unit 3</b>	ASP.Net, Working with ASP. Net Web Forms: Building ASP.Net Page, Building Forms with Web Server Controls, Performing Form Validation With Validation Control, Advanced Control Programming.	12
<b>Unit 4</b>	ADO.Net: Introduction to ADO. Net, Binding Data to web Control, Using the Data List and Data Grid Controls, Working with Data Sets and Error Handling.	12
<b>Unit 5</b>	Web Services: Introduction to Service-Oriented Architectures, XML basics, SOAP, SOAP message structure, WSDL, UDDI, Overview of Grid and Cloud Computing, Latest trends in Web technologies. A Case Study for developing interactive web applications	12

**Suggested Books:**

- 1) K.K. Sharma, "Web Technology", A.B. Publication Delhi, First Edition, 2008.
- 2) Stephen Walther, "ASP.NET" Pearson Education, Second Edition, 2004.
- 3) Ethan Cerami, "Web Services", O'Reilly Media, 2002.
- 4) Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill.
- 5) Heith Morneau, "Active Server Pages ", Vikas Publishing House.

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA- 035
<b>Paper Name</b>	Digital Image Processing
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Digital Image fundamentals: Why Computer Vision Difficult? Different stages of image processing and analysis, Component of image processing system, Sampling and Quantization, Some basic Relationship like Neighbor's connectivity, distance measure between Pixels.	12
<b>Unit 2</b>	Image Enhancement and restoration: basic intensity transformation histogram processing, Spatial domain methods: Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Frequency domain methods: Low pass filtering, High pass filtering, Image degradation and image restoration model.	12
<b>Unit 3</b>	Morphological image processing: basic morphology concepts, Dilation and Erosion, Opening and closing operation, Basic Morphological algorithms: Boundary extraction, hole filling, extraction of connected components.	12
<b>Unit 4</b>	Image segmentation: Detection of Discontinuities, Edge linking and Boundary Detection, Region base segmentation.	12
<b>Unit 5</b>	Image Compression: Fundamentals of image compression: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models: The Source Encoder and Decoder, The Channel Encoder and Decoder. Elements of Information Theory: Measuring Information, The Information Channel, Fundamental Coding Theorems, Using Information Theory. Error-Free Compression: Variable Length Coding, Bit- Plane Coding, Lossless Predictive Coding. Lossy Compression: Lossy Predictive Coding, Transform Coding.	12

**Suggested Books:**

- 1) Rafael. C. Gonzalez & Richard E. Woods.- Digital Image Processing, 2/e Pearson Education, New Delhi- 2006
- 2) W.K. Pratt.- Digital Image Processing, 3/e Edition., John Wiley & sons, Inc. 2006
- 3) M. Sonka et.al Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning India Edition, 2007.
- 4) Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
- 5) Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

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**DETAILED SYLLABUS**  
**2<sup>ND</sup> YEAR 4<sup>TH</sup> SEMESTER**

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA-041-E1
<b>Paper Name</b>	Artificial Intelligence
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction: Introduction to Artificial Intelligence, Foundations and history of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer Vision, Natural Language Processing.	12
<b>Unit 2</b>	Introduction to Search: Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Alpha-Beta pruning.	12
<b>Unit 3</b>	Knowledge Representation & Reason: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	12
<b>Unit 4</b>	Machine Learning: Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data- Naïve Bayes models, Learning with hidden data-EM algorithm, Reinforcement learning.	12
<b>Unit 5</b>	Pattern Recognition: Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Linear Discriminant Analysis (LDA). Classification Techniques-Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K-means clustering.	12

**Suggested Books:**

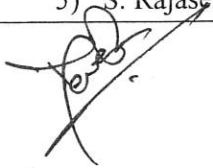
- 1) Stuart Russell, Peter Norvig, "Artificial Intelligence-A Modern Approach", Pearson Education
- 2) Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
- 3) E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
- 4) Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,

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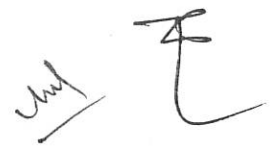
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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-041-E2</b>
<b>Paper Name</b>		<b>Soft Computing</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction: Introduction to soft computing; introduction to biological and artificial neural network; introduction to fuzzy sets and fuzzy logic systems.	12
<b>Unit 2</b>	Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms.	12
<b>Unit 3</b>	Artificial neural networks and applications: Different artificial neural network models; learning in artificial neural networks; neural network applications. Neural Nets and applications of Neural Network.	12
<b>Unit 4</b>	Fuzzy systems and applications: fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; fuzzy clustering; applications of fuzzy systems.	12
<b>Unit 5</b>	Applications: Pattern Recognitions, Image Processing, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) M.Mitchell: An Introduction to Genetic Algorithms, Prentice- Hall.</li> <li>2) J.S.R.Jang, C.T.Sun and E.Mizutani: Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.</li> <li>3) Timothy J.Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.</li> <li>4) Davis E.Goldberg: Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley.</li> <li>5) S. Rajasekaran and G.A.V.Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.</li> </ol>		



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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-041-E3</b>
<b>Paper Name</b>	<b>Pattern Recognition</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Basics of Probability. Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra. Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.	12
<b>Unit 2</b>	Bayes Decision Theory : Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features. Parameter Estimation Methods : Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.	12
<b>Unit 3</b>	Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method. Linear discriminant functions : Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.	12
<b>Unit 4</b>	Artificial neural networks: Multilayer perceptron - feedforward neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.	12
<b>Unit 5</b>	Non-metric methods for pattern classification : Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).	12

**Suggested Books:**

- 1) R. J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, Wiley, 2001. R. O. Duda and P. E. Hart, Pattern
- 2) Classification and Scene Analysis, Wiley, New York, 1973. L. Miclet, Structural Methods in Pattern Recognition North Oxford 3. Academic, London, 1986.
- 3) S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
- 4) C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-041-E4</b>
<b>Paper Name</b>	<b>Natural Language Computing</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Natural Language Processing – Linguistic Background – Mathematical Foundations - Morphological Analysis-Tokenization- Stemming-Lemmatization - Boundary Determination.	12
<b>Unit 2</b>	Reading unstructured data - Representing text data - Part of speech tagging - Syntactic representation - Text similarity - WordNet based similarity- Shallow parsing -Semantic representation.	12
<b>Unit 3</b>	Information retrieval and Information extraction - Named Entity Recognition - Relation Identification-Template filling.	12
<b>Unit 4</b>	Language model - Probabilistic Models - n-gram language models- Hidden Markov Model- Topic Modelling - Graph Models -Feature Selection and classifiers -Rule-based Classifiers - Maximum entropy classifier – Clustering-Word and Phrase-based Clustering.	12
<b>Unit 5</b>	Tools – Natural Language Tool kit, Apache OpenNLP. Applications of Text Analytics – Applications in Social media - Life science - Legal Text–Visualization - Case studies.	12

**Suggested Books:**

- 1) Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal. NLP: A Paninian Perspective , Prentice Hall, New Delhi, 1994. T.
- 2) Winograd. Language as a Cognitive Process, PEARSON Education.
- 3) Christopher D. Manning and Hinrich Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.
- 4) Steven Struhl, “Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence”, Kogan Page, 2015.
- 5) Matthew A. Russell, “Mining the Social Web”, O’Reilly Media, 2013.
- 6) 4. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, 1 st Edition, O’Reilly Media, 2009.

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-041-E5</b>
<b>Paper Name</b>	<b>Machine Learning</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction- overview of machine learning- Different forms of learning- Generative 6 learning- Gaussian parameter estimation- maximum likelihood estimation- MAP estimation- Bayesian estimation- bias and variance of estimators- missing and noisy features- nonparametric density estimation- applications- software tools.	12
<b>Unit 2</b>	Classification Methods-Nearest neighbour- Decision trees- Linear Discriminant Analysis - Logistic regression-Perceptrons- large margin classification- Kernel methods- Support Vector Machines. Classification and Regression Trees.	12
<b>Unit 3</b>	Graphical and sequential models- Bayesian networks- conditional independence Markov random fields- inference in graphical models- Belief propagation- Markov models- Hidden Markov models- decoding states from observations- learning HMM parameters	12
<b>Unit 4</b>	Clustering Methods-Partitioned based Clustering - K-means- K-medoids; Hierarchical Clustering - Agglomerative- Divisive- Distance measures; Density based Clustering - DBScan; Spectral clustering.	12
<b>Unit 5</b>	Neural networks- the perceptron algorithm- multilayer perceptron's- back propagationnonlinear regression- multiclass discrimination- training procedures- localized network structure- dimensionality reduction interpretation.	12

**Suggested Books:**

- 1) T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2009.
- 2) E. Alpaydin, "Machine Learning", MIT Press, 2010.
- 3) K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- 4) C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
- 5) Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
- 6) John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.

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**ELECTIVE -2**

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA-042-E1
<b>Paper Name</b>	Data Warehousing and Data Mining
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	The Compelling Need for data warehousing: Escalating Need for strategic information, failures of Past decision-support systems, operational versus decision-support systems, data warehousing-The only viable solution, data warehouse defined Data warehouse- The building Blocks: Defining Features, data warehouses and data marts, overview of the components, metadata in the data warehouse Dimensional analysis, OLAP operations: Drill-down and roll-up, siice-and-dice or rotaion.	12
<b>Unit 2</b>	Principles of dimensional modeling: the STAR schema, STAR Schema Keys, Advantages of the STAR Schema Dimensional Modeling: Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, aggregate fact tables, families of STARS, Steps for the Design & Construction of Data warehouse: Framework, Architecture, Type of OLAP Servers: ROLAP, MOLAP, Data warehouse implementation tolls & techniques.	12
<b>Unit 3</b>	Data Mining. Data Mining of what kind of Data, Knowledge discovery process (KDD), What kind of patterns can be mined OLAP versus data mining, data mining and the data warehouse,	12
<b>Unit 4</b>	Data mining, functionalities, classification Systems, Data processing: Cleaning, Integration & transformation, Reduction. Data Mining primitives: What defines a Data Mining Task?	12
<b>Unit 5</b>	Data Mining Query language ( DMQL), Cluster Analysis Partitioning, Hierarchical Density, Grid & Model based methods., Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining & applications	12

**Suggested Books:**

- 1) Kamber and Han, "Data Mining Concepts and Techniques", Harcourt India P. Ltd., 2001
- 2) Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons, 2003
- 3) W.H. Inmon, "Building the Operational Data Store", 2<sup>nd</sup> Ed., John Wiley, 1999
- 4) Jarke, "Fundamentals of Data Warehouse", Springer

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-042-E2</b>
<b>Paper Name</b>	<b>Cloud Computing</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Understanding cloud computing: Recent trends in computing: Grid computing, Cluster computing, Distributed computing, Cloud computing, Evaluation of Cloud Computing – History of Cloud Computing, Advantages of Cloud Computing- Disadvantage of cloud computing, Companies in the Cloud Today.	12
<b>Unit 2</b>	Cloud Computing Architecture : Cloud Computing stack, Service models: Infrastructure as a service(IaaS), Platform as a service (PaaS), Software as a service (SaaS), Deployment Models, IaaS Introduction to virtualization and different approaches of virtualization, Resource virtualization : server, storage, platform.	12
<b>Unit 3</b>	Developing cloud services: Platform as a service (PaaS): Service oriented Architecture, Cloud platform and management: Computation and Storage, Example: Google App Engine, Microsoft Azure, Software as a service (SaaS): Web Service, Web 2.0, Web OS. Examples of Software as a service.	12
<b>Unit 4</b>	Service Management in cloud Computing: Service level Agreements (SLAs), Billing and Accounting, Comparing scaling hardware: traditional vs cloud Cloud Security: Infrastructure security, Data security and storage, Access control, Authentication in cloud computing.	12
<b>Unit 5</b>	Cloud computing for everyone: Centralizing Email Communications, Collaborating on Schedules, and Collaborating on To-Do Lists, Collaborating Contact Lists, and Cloud Computing for the Community, Collaborating on Group Projects and Events, Cloud Computing for the Corporation.	12

**Suggested Books:**

- 1) Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
- 2) Cloud Computing: Principles and ,Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
- 3) Cloud Computing : Principles, Systems and Applications, Editors. Nikos Antonopoulos, Lee Gillam, Springer, 2012.
- 4) Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.

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<b>Internal Assessment:</b>	<b>30%</b>	<b>End Semester Exam:</b>	<b>70%</b>
<b>Paper Code</b>	<b>MCA-042-E3</b>		
<b>Paper Name</b>	<b>Big Data Analytics</b>		
<b>Contacts</b>	<b>3L + 1T</b>		
<b>Credits</b>	<b>4</b>		
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>	
<b>Unit 1</b>	Introduction to big data : Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.	12	
<b>Unit 2</b>	Mining data streams : Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.	12	
<b>Unit 3</b>	Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features Hadoop environment.	12	
<b>Unit 4</b>	Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams.	12	
<b>Unit 5</b>	Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.	12	

**Suggested Books:**

- 1) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
- 2) Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
- 3) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
- 4) Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
- 5) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
- 6) Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
- 7) Pete Warden, "Big Data Glossary", O'Reilly, 2011.
- 8) Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier.
- 9) Da Ruan, Guoqing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007.
- 10) Paul Zikopoulos, Dirk de Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
- 11) Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach", VPT, 2016
- 12) Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-042-E4</b>
<b>Paper Name</b>		<b>Software Project Management</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction and Software Project Planning Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document Project Management Cycle, SPM Objectives, Management Spectrum, LPM Framework, Software Project Planning, Planning Objective, Project Plan, Types of project plan, Software project estimation, Estimation methods, Decision process.	12
<b>Unit 2</b>	Project Organization and Scheduling Project Elements, Work Breakdown Structure (WBS), Project Life Cycle and Product Life Cycle, Project schedule, Building the project schedule, Scheduling terminology and techniques, Network Diagrams, Bar Charts:	12
<b>Unit 3</b>	Project Monitoring and Control, Dimension of Project, 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), Software Reviews, Types of Review: Inspections, Walkthroughs, Code Reviews, Pair Programming.	12
<b>Unit 4</b>	Software Quality Assurance and Testing, 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, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Clean room process.	12
<b>Unit 5</b>	Project Management and Project Management Tools Software Configuration Management: Software Configuration Items and tasks, Plan for Change, Change Control, Change Requests Managements, Risk Management: risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning Risk monitoring, Cost Benefit CASE Tools, Planning and Scheduling Tools.	12
<b>Suggested Books:</b>		
6) M. Cotterell, Software Project Management, Tata McGraw-Hill Publication. 7) Royce, Software Project Management, Pearson Education 8) Kieron Conway, Software Project Management, Dreamtech Press 9) S.A. Keldar, Software Project Management, PHI Publication		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA-042-E5
<b>Paper Name</b>	Software Testing & Quality Assurance
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
Unit 1	Software Quality Assurance and Standards: The Software Quality challenge, What is Software Quality, Software Quality factors, The components of Software Quality Assurance system, Software Quality Metrics, Costs of Software Quality, Quality Management Standards, Management and its role in Software Quality Assurance, SQA unit and other actors in SQA system. Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma and other latest quality standards	12
Unit 2	Software Testing Strategy and Environment: Minimizing Risks, Writing a Policy for Software Testing, Economics of Testing, Testing-an organizational issue, Management Support for Software Testing, Building a Structured Approach to Software Testing, Developing a Test Strategy Building Software Testing Process: Software Testing Guidelines, workbench concept, Customizing the Software Testing Process, Process Preparation , Software Testing Techniques: Dynamic Testing – Black Box testing techniques, White Box testing techniques, Static testing, Validation Activities, Regression testing	12
Unit 3	Software Testing Tools: Selecting and Installing Software Testing tools, Automation and Testing Tools ,Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, JMetra, JUNIT and Cactus.	12
Unit 4	Testing Process: Seven Step Testing Process – I: Overview of the Software Testing Process, Organizing of Testing, Developing the Test Plan, Verification Testing, Validation Testing.	12
Unit 5	Seven Step Testing Process – II: Analyzing and Reporting Test results, Acceptance and Operational Testing, Post-Implementation Analysis Specialized Testing Responsibilities: Software Development Methodologies, Testing Client/Server Systems.	12

**Suggested Books:**

- 1) Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India, 2009
- 2) Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press, 2010.
- 3) Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education, 2009.
- 4) Software Quality Models and Project Management in a Nutshell, Shailesh Mehta, Shroff Publishers and Distributors, 2010.
- 5) Foundations of Software Testing, Dorothy Graham, et al., Cengage learning, 2007, rp 2010.
- 6) Software Testing – Effective Methods, Tools and Techniques, Renu Rajani, Pradeep Oak, Tata McGraw-Hill, rp2011.
- 7) Software Automation Testing Tools for Beginners, Rahul Shende, Shroff Publishers and Distributors, 2012.
- 8) Testing Computer Software, Cem Kaner, Jack Falk, Hung Quoc Nguyen, Wiley India, rp2012.
- 9) Software Testing Tools, K.V.K.K. Prasad, Dream Tech Press, 2008

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-043-E1</b>
<b>Paper Name</b>		<b>Internet of Things</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs – IoTvs M2M.	12
<b>Unit 2</b>	IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development. Physical Device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web Services	12
<b>Unit 3</b>	Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks . Various Real Time Applications of IoT- Connecting IoT to Cloud – Cloud Storage for IoT – Data Analytics for IoT – Software & Management Tools for IoT	12
<b>Unit 4</b>	Building a program and deploying to a device, writing to Actuators, Blinking Led, Reading from Sensors, Light Switch, Voltage Reader, Device as HTTP Client, HTTP, Push Versus Pull Pachube, Netduino, Sending HTTP Requests—the Simple Way, Sending HTTP Requests—the Efficient Wa	12
<b>Unit 5</b>	Multithreading, Parallel Blinker, prototyping online components, using an API, from prototypes to reality, business models, ethics, privacy, disrupting control, crowdsourcing	12

**Suggested Books:**

- 1) Arshdeep Bahga, Vijay Madi setti, —Internet of Things – A Hands-on Approach□, Universities Press, 2015.
- 2) Manoel Carlos Ramon, —Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers□, Apress, 2014.
- 3) Marco Schwartz, —Internet of Things with the Arduino Yun□, Pack Publishing, 2014.
- 4) Simon Monk, —Programming the Raspberry Pi: Getting Started with Python□, Mc Graw Hill, 2013.
- 5) CharalamposDoukas,□Building Internet of Things With the Arduino□, Second Edition, 2012.
- 6) Dr.John Bates, —Thingalytics: Smart Big Data Analytics for the Internet of Things□, Software AG Publisher, 2015.
- 7) Cuno Pfister, “Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud”, Maker Media, 2011.

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	<b>MCA-043-E2</b>
<b>Paper Name</b>	<b>Compiler Design</b>
<b>Contacts</b>	<b>3L + 1T</b>
<b>Credits</b>	<b>4</b>

S.No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	12
<b>Unit 2</b>	Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient parsers: LR parsers, the canonical Collection of LR (0) items, construction SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, and implementation of LR parsing tables.	12
<b>Unit 3</b>	Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax-directed translators, Intermediated code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translations, translation with a top down parser. More about translation.	12
<b>Unit 4</b>	Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	12
<b>Unit 5</b>	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 Optimization, Loop optimization, representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis	12

**Suggested Books:**

- 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

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA-043-E3
<b>Paper Name</b>	Quantum Computing
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S.No	Topic	No of Lectures (Approx.)
Unit 1	Quantum Computing History, Postulates of Quantum Theory, Dirac Notation, the Quantum Circuit Model, Simple Quantum Protocols: Teleportation, Superdense Coding, Foundation Algorithms.	12
Unit 2	Complex numbers and its geometrical representations, Complex vector spaces, inner products and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces	12
Unit 3	Deterministic Systems, Probabilistic descriptions and Quantum systems, Basics of Quantum theory, Schrodinger's time dependent equation. Wave nature of Particles, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states, entanglement	12
Unit 4	Bits and Qubits, Classical gates versus quantum gates, Deutsch's Algorithm, DeutschJozsa Algorithm, Simon's periodicity algorithm, Grover's search algorithm, Shor's Factoring algorithm	12
Unit 5	Quantum programming languages, Probabilistic and Quantum computations, introduction to quantum cryptography and quantum information theory	12

- Suggested Book:**
- 1) Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
  - 2) Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008
  - 3) Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010
  - 4) Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall
  - 5) Sahni V —Quantum Computing, McGraw Hill Education Asia Ltd, 2007

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<b>Internal Assessment: 30%</b>		<b>End Semester Exam: 70%</b>
<b>Paper Code</b>		<b>MCA-043-E4</b>
<b>Paper Name</b>		<b>Client Server Computing</b>
<b>Contacts</b>		<b>3L + 1T</b>
<b>Credits</b>		<b>4</b>
<b>S.No</b>	<b>Topic</b>	<b>No of Lectures (Approx.)</b>
<b>Unit 1</b>	CLIENT/SERVER COMPUTING:- DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.	12
<b>Unit 2</b>	COMPONENTS OF CLIENT/SERVER APPLICATION:- The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services & Other Services, Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system.	12
<b>Unit 3</b>	CLIENT/SERVER NETWORK:- connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client-Server System Hardware: Network Acquisition, PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.	12
<b>Unit 4</b>	DATA STORAGE:- magnetic disk, magnetic tape, CD-ROM, WORM, Optical disk, mirrored disk, fault tolerance, RAID, RAID-Disk network interface cards. Network protection devices, Power Protection Devices, UPS, Surge protectors. Client Server Systems Development: Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues.	12
<b>Unit 5</b>	CLIENT/SERVER SYSTEM DEVELOPMENT:- Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training. The future of client server Computing Enabling Technologies, The transformational system.	12
<b>Suggested Books:</b>		
<ol style="list-style-type: none"> <li>1) Patrick Smith &amp; Steave Guengerich, "Client / Server Computing", PHI</li> <li>2) Dawna Travis Dewire, "Client/Server Computing", TMH</li> <li>3) Majumdar &amp; Bhattacharya, "Database management System", TMH</li> <li>4) Korth, Silberchatz, Sudarshan, "Database Concepts", McGraw Hill</li> <li>5) Elmasri, Navathe, S.B, "Fundamentals of Data Base System", Addison Wesley</li> </ol>		

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<b>Internal Assessment:</b> 30%	<b>End Semester Exam:</b> 70%
<b>Paper Code</b>	MCA-043-E5
<b>Paper Name</b>	Simulation & Modeling
<b>Contacts</b>	3L + 1T
<b>Credits</b>	4

S. No	Topic	No of Lectures (Approx.)
<b>Unit 1</b>	Introduction: Concept of a system, stochastic activities, continue and discrete system, system modeling, mathematical modeling, principle used in modeling.	12
<b>Unit 2</b>	Simulation of Systems: Concepts of simulation of continuous systems with the help of two examples; use of integration formulas; concepts of discrete system simulation with the help of two examples, Generation of random numbers, Generation of non-uniformly distributed numbers.	12
<b>Unit 3</b>	Simulation of Queuing Systems: Rudiments of queuing theory, Simulation of Single-Server queue, two-server queue, general queues.	12
<b>Unit 4</b>	Simulation in Inventory Control and Forecasting: Elements of inventory theory, inventory models, generation of Poisson and Erlang variants, forecasting and regression analysis.	12
<b>Unit 5</b>	Design and Evaluation of Simulation Experiments: Experimental layout and validation. Simulation Languages: Continuous and discrete simulation languages, Block-Structured continuous simulation languages, expression based languages discrete system simulation languages, simscripte, GPSS, SIMULA, Simpack, GASP IV, CSIM, factors in selection of a discrete system simulation languages Case Studies: Analytic Vs Simulation Models, Databases, Computer Networks Architectures.	12

**Suggested Books:**

- 1) Narsingh Deo, "System Simulation with Digital Computer", Prentice-Hall of India Pvt. Ltd.-1993,
- 2) Gordon, "System Simulation", Prentice Hall of India Pvt. Ltd.-1993
- 3) Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
- 4) Averill M. Law: Simulation Modeling and Analysis. 4 th Edition, Tata McGraw-Hill, 2007

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