

# Course Curriculum

## 2-Year M.C.A Degree Programme (Batch 2020-22) Credit Structure

### Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week
1	I	32	50
2	II	32	40
3	III	32	40
4	IV	24	36
<b>Total</b>		120	166

## Course Structure: M.C.A. (For session 2022-23 onwards)

### Semester – I

S. No.	Course Code	Course Title	L	T	P	Credit(s)	Internal	External	Total	
1	MCA-T101	Web Technologies	3	1	0	4	20	80	100	
2	MCA-T102	Operating System	3	1	0	4	20	80	100	
3	MCA-T103	Database Management System	3	1	0	4	20	80	100	
4	MCA-T104	MIS & E-Commerce	3	1	0	4	20	80	100	
5	MCA-T105	Python Programming	3	1	0	4	20	80	100	
6	MCA-T106	Advanced Data Structure	3	1	0	4	20	80	100	
7	MCA-P101	DBMS Lab	0	0	8	4	20	80	100	
8	MCA-P102	Python Programming Lab	0	0	8	4	20	80	100	
9*	MCA-B101	Data Structure	3	1	0	Audit	20	80		
10*	MCA-B102	Basic Mathematics	3	1	0	Audit	20	80		
Total Credits						32				
Total Contact hours /week						50				
Total Marks								160	640	800

**\*Bridge Course [For students other than BCA / B.Sc. (CS/IT) or 12<sup>th</sup> level]**

It will be an audit course for Non Computer Graduates. No Marks will be added. But Student has to pass this Course; in order have basic knowledge of Computer Science.

#### **Guidelines for Evaluation of Bridge Course**

Students except BCA / B.Sc. (CS/IT) have to qualify a Bridge Course as per University norms.

- Bridge course shall be an Audit Course whose award shall not be considered for overall MCA Course credit and percentage. However, the grades will be reflected in the mark sheet of the student.
- The students have to clear the Bridge Course before the End Term Examination of third semester.

## Semester – II (For session 2021-22 onwards)

S. No.	Course Code	Course Title	L	T	P	Credit(s)	Internal	External	Total
1	MCA-T201	Design & Analysis of Algorithms	3	1	0	4	20	80	100
2	MCA-T202	Java Programming	3	1	0	4	20	80	100
3	MCA-T203	Software Engineering	3	1	0	4	20	80	100
4	MCA-T204	Computer Networks	3	1	0	4	20	80	100
5	MCA-T205	Computer Architecture	3	1	0	4	20	80	100
6	MCA-E206	Departmental Elective I	3	1	0	4	20	80	100
7	MCA-P201	Minor Project	0	0	8	4	20	80	100
8	MCA-P202	Java Programming Lab	0	0	8	4	20	80	100
		Total credits				32			
		Total Contact hours/week				40			
		Total					160	640	800

## Semester – III (For session 2022-23 onwards)

	Course Code	Course Title	L	T	P	Credit(s)	Internal	External	Total
1	MCA-T301	Artificial Intelligence and Machine Learning	3	1	0	4	20	80	100
2	MCA-T302	Digital Marketing	3	1	0	4	20	80	100
3	MCA-T303	Embedded Systems	3	1	0	4	20	80	100
4	MCA-T304	Information Systems & Cyber Security	3	1	0	4	20	80	100
5	MCA-E305	Departmental Elective-II	3	1	0	4	20	80	100
6	MCA-E306	Departmental Elective-III	3	1	0	4	20	80	100
7	MCA-P301	Embedded Systems Lab	0	0	8	4	20	80	100
8	MCA-P302	Artificial Intelligence and Machine Learning Lab	0	0	8	4	20	80	100
		Total Credits				32			
		Total Contact hours/week				40			
		Total Marks					160	640	800

## Semester – IV (For session 2021-22 onwards)

	Course Code	Course Title	L	T	P	Credit(s)
1	MCA-P401	Industry Project	0	0	36	24
Total Credits						24
Total Contact hours/week						36
Total Marks(Internal + External)						20+80=100

### List of Departmental Elective(s) – I

S. No	Course Code	Course Title	L	T	P	Credit
1.	MCA-E206-1	Content Management and Web Development	3	1	0	4
2.	MCA- E206-2	Cloud Computing	3	1	0	4
3.	MCA- E206-3	Real Time Systems	3	1	0	4
4.	MCA- E206-4	Business Intelligence in ERP System	3	1	0	4
5.	MCA- E206-5	Image Processing	3	1	0	4
6.	MCA- E206-6	Mobile Computing	3	1	0	4

### List of Departmental Elective(s) – II

S. No	Course Code	Course Title	L	T	P	Credit
1.	MCA- E305-1	Software Testing	3	1	0	4
2.	MCA- E305-2	Robotics	3	1	0	4
3.	MCA- E305-3	Internet of Things	3	1	0	4
4.	MCA- E305-4	Compiler Design	3	1	0	4
5.	MCA- E305-5	Bio-Informatics	3	1	0	4

### List of Departmental Elective(s) – III

S. No	Course Code	Course Title	L	T	P	Credit
1.	MCA- E306-1	Ethical Hacking and Digital Forensics	3	1	0	4
2.	MCA- E306-2	Data Mining and Data Warehousing	3	1	0	4
3.	MCA- E306-3	Soft Computing	3	1	0	4
4.	MCA- E306-4	Ad Hoc Networks	3	1	0	4
5.	MCA- E306-5	Natural Language Processing	3	1	0	4

# **M.C.A. SEMESTER – I**

## **MCA-T101            Web Technologies**

### **UNIT I**

Introduction of HTML: introduction, markup language, editing HTML: common tags, headers, text styles, linking, images, formatting text, horizontal rules and more line breaks, unordered lists, nested and ordered lists, basic HTML tables: intermediate HTML tables and formatting: basic HTML forms, more complex HTML forms, HTML5: Input Types & Attributes, internal linking, creating and using image maps

### **UNIT II**

Java script Introduction to scripting: introduction- memory concepts- arithmetic- decision making. Java script control structures, Java script functions: introduction, program modules in java script - function definitions, duration of identifiers, scope rules, recursion, java script global functions. Java script arrays: introduction, array-declaring and allocating arrays, introduction to DHTML and J Query.

### **UNIT III**

CSS: introduction, inline styles, creating style sheets with the style element, conflicting styles, linking external style sheets, positioning elements, backgrounds, element dimensions, text flow and the CSS box model, user style sheets.

### **UNIT IV**

HTML : HTML form using GET, POST, REQUEST, SESSION, COOKIE variables, Sending E-mail, Database Operations with PHP, Connecting to My-SQL (or any other database), selecting a db.

### **UNIT V**

Introduction to PHP & web server Architecture Model Overview of PHP Capabilities, PHP HTML embedding tags & syntax, Simple script examples, PHP & HTTP Environment variables. PHP Language Core-Variables, constants, data types, PHP operators, flow control & loops, Arrays, string, functions Include & require statements, Simple File & Directory access operations, Error handling, Processing

## Recommended Books

1. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHI/Pearson Education.
2. Internet and World Wide Web, H.M. Deitel, P.J. Deitel, A.B. Goldberg Pearson Education
3. Web Technologies Black Book Dreamtech Press (2018)

## MCA-T102

## Operating System

### UNIT I

**Introduction to Operating Systems:** Mainframe systems, desktop systems, multiprocessor systems, distributed systems, clustered systems, real-time systems, handheld systems. Feature migration and computing Environments.

**Computer System Structures:** Computer system operation, I/O structure, storage structure, storage hierarchy, hardware protection, network structure.

**Operating System Structures:** System components, operating system services. System calls, system programs, system structure, virtual machines.

### UNIT II

**Processes:** Process concept, process scheduling, operations on processes, cooperating processes, Inter-process communication, communication in client-server systems.

**Threads:** Overview, multithreading models, threading issues.

### UNIT III

**CPU Scheduling:** Basic Concepts, scheduling criteria, scheduling algorithms, multiple- processor scheduling, real-time scheduling, algorithm evaluation.

**Process Synchronization:** The critical section problem, synchronization hardware, semaphores, classical problems of synchronization, monitors.

**Deadlocks:** System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

### UNIT IV

**Storage and Memory Management:** Swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

**Virtual Memory:** Demand paging, process creation, page replacement, allocation of frames, thrashing.

**File System Interface:** File concept, access methods, directory structure, file system mounting, file sharing, protection.

**File-System Implementation:** File system structure, file-system implementation, directory implementation, allocation methods, free space management, efficiency and performance.

## **UNIT V**

**Protection:** Goals of protection, domain of protection, access matrix, implementation of access matrix, revocation of access rights.

**Security:** The security problem, user authentication, program threats, system threats, security systems and facilities, intrusion detection, cryptography.

### **Recommended Books**

1. Operating System Concepts, Silberschatz G.G., John Wiley & Sons Inc.
2. Modern Operating Systems, Andrew S. Tanenbaum, Pearson Prentice Hall,
3. Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems, Mukesh Singhal and Niranjana G. Shivaratri, Tata McGraw-Hill
4. Operating Systems: A Concept-based Approach, Dhananjay M. Dhamdhare, Tata McGraw-Hill Education.
5. Distributed Systems: Concepts and Design, Coulouris et al, Addison Wesley.
6. Tanenbaum and Steen: Distributed Systems: Principles and Paradigms, Pearson Education

## **MCA-T103**

## **Database Management System**

### **UNIT I**

Introduction: Database system applications, database systems versus file systems, views of data, data models, database languages, database users and administrators, transaction management, database system structure, application architecture.

Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, unique key, generalization, aggregation, reduction of an ER diagram to tables.

### **UNIT II**

Relational model: Structure of relational databases, relational algebra, tuple relational calculus, domain relational calculus.

SQL: Characteristics of SQL, advantages of SQL, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub-queries, aggregate functions, insert, update and delete

operations, joins, union, intersection, minus, cursors in SQL. Domain constraints, referential integrity, assertions, triggers, authorization and authentication.

Relational database design & normalization: Functional dependencies, normal forms- First, second, third, BCNF, fourth and fifth normal forms, decomposition.

### **UNIT III**

Indexing and Hashing: Basic concepts, ordered indices, B-tree, B+ tree, static hashing, dynamic hashing, comparison of ordered indexing and hashing, index definition in SQL, multiple-key access. Query Processing & Optimization: Measure of query cost, selection operation, sorting, join operation, other operations

### **UNIT IV**

Transactions: Transaction concept, atomicity and durability, concurrent execution, serializability, conflict and view, testing of serializability.

Concurrency Control: Concurrency Control, Locking Techniques for Concurrency control, Time stamping protocols for concurrency control, validation-based protocols,

Recovery System: Failure classification, storage structure (RAID), recovery and atomicity, log based recovery, shadow paging

### **UNIT V**

Object Oriented Database Concept: Data types and Object, Evolution of Object-Oriented Concepts, Characteristics of Object-Oriented Data Model. Object Hierarchies, Generalization, Specialization, Aggregation. Object Schema. Inter-object Relationships, Similarities and difference between Object Oriented Database model and Other Data models.

Object Oriented DBMS Architecture, Application Selection for Object Oriented DBMS, Database Design for an Object Relational DBMS. Data Access API (ODBC, DAO, ADO, JDBC, OLEDB) **Recommended**

### **Books**

1. Database Systems Concepts, Korth
2. Fundamental of database system - Elmasiri and Navathe
3. Database Systems, Date C.J., AddisonWesley
4. DBM and Design, Hansen and Hansen, PHI
5. Distributed Databases, Ceri S, Pelagatti G, Principles and Systems, McGraw Hill.



# **MCA-T104            Management Information System (MIS) and E-Commerce**

## **UNIT I**

**Management Information Systems** - Need, Purpose and Objectives- Contemporary Approaches to MIS – Business processes and Information Systems –Information systems function in Business-Use of Information Systems for competitive advantage - MIS as an instrument for the organizational change: Management issues – Types of Business Information Systems.

## **UNIT II**

**Enhancing Decision Making:** Information, Management and Decision Making - Models of Decision Making - Classical, Administrative and Herbert Simon's Models - Attributes of information and its relevance to Decision Making - Types of information, Decision Support Systems - Group Decision Support Systems – Executive Support Systems

## **UNIT III**

**E-commerce:** Introduction, Definition of e-commerce, emergence of Internet, commercial use of Internet, history of e-commerce, advantages and disadvantages of e-commerce

**Business models for e-commerce:** B2C, B2B, C2C, C2B, brokerage model, aggregator model, infomediaries, communities, value-chain model, manufacturer model, advertising model, subscription and affiliate model

## **UNIT IV**

**Enabling technologies:** Internet Client server applications, networks, Uniform Resource Locator (URL), search engines, software agents, Internet Service Providers(ISP), broadband technologies,

Electronic Data Interchange(EDI).

**E-payment systems:** token-based system, card-based system, e-cash. E-cheque, e-banking, risks, data protection

## **UNIT V**

**E-marketing:** characteristics, methods, e-marketing value-chain, site adhesion, browsing behavior model, e-advertising, e-branding, e-marketing strategies

**E-security:** Security risks, risk management issues, legal and ethical issues, security mechanisms, encryption, digital signature, digital certificates,

## **Recommended Books**

1. Management Information Systems, Laudon and Laudon, 7th Edition, Pearson Education Asia
2. P.T. Joseph, S.J. E-commerce: An Indian Perspective, Prentice Hall India, Second Edition, 2007

**UNIT I****INTRODUCTION TO PYTHON**

Python installation, Python syntax, Scripts, Native Data Types, Booleans, Numbers, Lists, Tuple, Sets, Dictionaries, Comprehensions, List Comprehensions, Dictionary Comprehensions, Set Comprehensions

**UNIT II****STRINGS AND MODULES**

String operation, Formatting, Bytes, Encoding, Regular Expressions, Verbose, module declaration, Importing modules, Objects, and Indenting as Requirement, Exceptions, Unbound Variables, Lambda Functions and map

**UNIT III****CLASSES**

Creating classes, instance methods, Instance Variables, Closures, Generators, Iterators, Assert, Generator Expressions

**UNIT IV****TESTING AND FILES**

Reading and Writing Text Files, Binary Files, Stream Objects, Standard Input, Output and Error, modes, with statement

**UNIT V****GUI IN PYTHON**

Components and events, root component, entry widgets, text widgets, check buttons, Serializing Objects, Pickle Files, Debugging, Introduction to Django framework

**Recommended Books**

1. Dive into Python, Mark Pilgrim, Apress,
2. How to Think Like a Computer Scientist Learning with Python Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press,
3. Introduction to Computation and Programming using Python, John V. Guttag, Prentice Hall of India.
4. Learning Python: Powerful Object-Oriented Programming, Mark Lutz, O'Reilly, Shroff Publishers and Distributors.

**UNIT I**

**Priority Queues (Heaps)** – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations.

**UNIT II**

**Trees:** Threaded trees and advantages, Applications: Decision trees, Game trees and expression parsing. Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion.

Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree.

**UNIT III**

**Graphs:** Graphs and their representations: Matrix representation ,List structure ,Graph traversal algorithm (DFS and BFS), Application of graphs. Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm.

**UNIT IV**

**Strings and their features:** Strings-Representation and Manipulation using Arrays and lists- String matching algorithms. Brute force, Knuth-Morris-Pratt and Boyer-Moore strategies. The Huffman Coding Algorithm, Longest Common Subsequence Problem (LCS)

**Tables:** Decision tables-Symbol tables-Hash Tables-Examples of representation and implementation and Applications.

**UNIT V**

**Disjoint Sets** – Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm.

**Review of Hashing:** Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing

**Reference Books:**

1. Data Structure & Algorithms, Aho A.V. & Ullman J.E.
2. Introduction to Data Structures, Bhagat Singh & Thomas Naps.
3. Introduction to Algorithms, Charles Leiserson, Ronald Rivest, & Thomas H. Cormen, MIT Press

## **MCA-P101**

## **DBMS Lab**

Lab Based on course MCA T103

## **MCA-P102**

## **Python Programming Lab**

Lab Based on courses MCA T105

## **MCA- B101\***

## **Data Structure**

### **UNIT I**

**Data Type** - Data Object - Data Structure: Data abstraction and abstract data type; Notion of an algorithm - Complexity measures: Rate of growth, basic time analysis of an algorithm; ordering notion- detailed timing analysis - space complexity.

**Arrays:** Arrays and their representation-Single and multidimensional arrays-row major and column major ordering-address calculation.

### **UNIT II**

**Stacks and Queues:** Stacks and Queues-representation and Manipulation-Uses of stacks and Queues- Recursion, polish expressions

**Storage Management:** Dynamic storage management-Reclamation and compaction-Boundary Tag method.

### **UNIT III**

**Linked lists:** Pointers and their uses- Continuous vs. linked storage. Singly and doubly linked lists- Operations on lists-representation of sparse matrices and polynomials using lists- Circular lists- generalized lists

### **UNIT IV**

**Trees:** Trees-Binary and N-ary trees-Representation of trees-Tree traversal algorithms and advantages- Conversion of general trees to Binary trees-B trees- Applications:

### **UNIT V**

**Sorting and Searching:** Searching and sorting-Sequential, Binary and hashed Searching- Bubble sort, Insertion sort, shell sort, Merge sort and Quick sort-Comparison.

### **Recommended Books**

1. Data Structure & Algorithms, Aho A.V. & Ullman J.E.
2. Data Structures using C, Aron M. Tannenbaum.

3. Data Management & File Structures, Mary E.S. Loomis.
4. Introduction to Data Structures, Bhagat Singh & Thomas Naps.
5. An Introduction to Data Structures with Applications, Trembley & Sorenson.

## **MCA-B102\***

## **Basic Mathematics**

### **UNIT I**

Set theory: Sets and their representations; The empty set; finite and infinite sets; equal and equivalent sets; subsets; power set; universal set; Venn diagrams; complement of a set operations on sets; applications of sets.

Mathematical Logic: Basic Logical connections; Conjunction; Disjunction; Negation; Negation of Compound Statements; Truth tables. Tautologies; Logical Equivalence; Applications.

### **UNIT II**

Matrices and Determinants: Definition of a matrix; Operations on matrices; Square Matrix and its inverse; determinants; properties of determinants; the inverse of a matrix; solution of equations using matrices and determinants; solving equations using determinants.

### **UNIT III**

Counting: Basic counting principles, factorial notation, binomial coefficient, permutations, combinations, the pigeon-hole principle, the inclusion-exclusion principle, ordered and unordered partition.

### **UNIT IV**

Probability: Concept of probability; sample space and events; three approaches of probability; kolmogorov's axiomatic approach to probability; conditional probability and independence of events; bay's theorem.

### **UNIT V**

Property of Integers: Order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations.

### **Recommended Books**

1. Discrete Mathematics, Lipschutz S., Lipson M.
2. Discrete Mathematical Structures, Kolman B., Robert C.B., Sharon R.
3. Discrete Mathematical Structures with Applications to Computer Science, Trembley J.P. and Manohar R.P.
4. Introduction to Discrete Mathematics, Liu, McGraw-Hill
5. Discrete Mathematical Structures for Compute Science, Kolman B., Busby R, PHI

# M.C.A. SEMESTER – II

## MCA-T201

## Design & Analysis of Algorithms

### UNIT-I

Algorithms Analysis: Algorithms and structured programming. Analyzing algorithms, Asymptotic behavior of an algorithm, Order notations, time and space complexities average and worst case analysis, lower and upper bounds.

### UNIT-II

Algorithm design strategies: Divide and conquer (Merge sort, Quick sort, matrix multiplication), Greedy method (knapsack problem, minimum spanning trees).

Basic search & Traversal Techniques (Breadth first and Depth first traversals of Graphs).

### UNIT-III

Dynamic programming: 0/1 knapsack, Travelling salesman problem

Backtracking: 8-queen problem, sum of subsets, Graph coloring, 0/1 Knapsack,

Branch & Bound: 0/1 knapsack, Travelling salesman.

### UNIT-IV

Matrix algorithms: Basics, Strassen's matrix-multiplication algorithm

Data structures for set manipulation problems: Fundamental operation on sets, a simple disjoint-set union algorithm, tree structures for UNION-FIND problem, applications and extensions of the UNION-FIND algorithm.

### UNIT-V

Finite automata and regular expression, recognition of regular expression, patterns, recognition of substrings, Conversion from NFA to DFA

Complexity Theory: Overview, Turing machine, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P class, NP class & NP complete problems- vertex cover and 3-SAT and NP-hard problem, Hamiltonian cycle.

### Recommended Books

1. Fundamentals of Computer Algorithms, E. Horowitz, S. Sahni, Galgotia Publications.
2. Introduction to Algorithms, Charles Leiserson, Ronald Rivest, & Thomas H. Cormen, MIT Press
3. Design & Analysis of Computer Algorithms, Av. Aho, J.E. Hopcroft, & J.D. Ullman, Addison Wesley.
4. Design and Analysis of algorithms, S.K. Basu, PHI Publications

## **MCA-T202 Java Programming**

### **UNIT-I**

OOPS Concepts: Encapsulation, Inheritance and polymorphism, Classes and data abstraction, constructors and destructors,

### **UNIT-II**

Packages and Interfaces, Access Control, Method Overriding, Garbage Collection, Abstract Classes,

Exceptions handling, throwing an exception, try block, catching an exception, Multithreading, Synchronization

### **UNIT-III**

**J2EE Platform:** Enterprise architecture style (2 tier, 3 tier, N tier), J2EE run time, J2EE APIs, J2EE technology, web components

JDBC Overview, JDBC implementation, Connection class, Statements, Types of statement objects (Statement, Prepared Statement and Callable Statement), and Types of result set

### **UNIT-IV**

**Servlet:** Servlet API, Overview of Servlet, Servlet Life Cycle, HTTP Methods, Attributes in Servlet, Request Dispatcher interface

### **UNIT-V**

**Java Server Pages:** JSP Overview, Problem with Servlet, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, JSP Directives, JSP Action, JSP Implicit objects, JSP Session and Cookies Handling

### **Recommended Books**

1. Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest  
Wiley Publication
2. Spring in Action 3rd edition , Craig walls, Manning Publication
3. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication
4. Java Server Faces in Action, Kito D. Mann, Manning Publication
5. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
6. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress
7. Complete Reference J2EE by James Keogh McGraw publication

**UNIT I****Software Engineering**

Fundamentals: Definition of Software, Software characteristics, Software Applications.

**Software Process:**

Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model.

Project management Concepts: The Management Spectrum - The People, The Product, The Process, The Project.

**UNIT II**

**Software Process and Project Metrics:** Measures, Metrics and Indicators, Software measurement: Size - Oriented Metrics, Function - Oriented Metrics, Extended Function point metrics

**Software Project Planning:** Project Planning Objectives, Software Project Estimation, Decomposition Techniques - Problem Based Estimation, Process Based Estimation, Empirical Estimation Models- The COCOMO Model

**Risk Analysis and Management:** Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring and Management.

**UNIT III**

**Software Quality Assurance: Basic concepts-** Quality, Quality Control, Quality Assurance, Cost of Quality, Software Quality Assurance (SQA), Formal Technical Review

**Software Configuration Management:** Baselines, Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting.

**Analysis Concepts and Principles:** Requirements Elicitation for Software, Analysis Principles -The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)

**UNIT IV**

**Design Concepts and Principles:** Design Principles, Design Concepts, Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure,



Software Procedure, Information Hiding, Effective Modular Design- Cohesion, Coupling

## **UNIT V**

**Software Testing:** Testing Objectives & principles, Unit Testing, Integration Testing (Top Down Integration, Bottom Up Integration, Regression Testing, Smoke Testing ), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing, Performance Testing).

**Reengineering:** Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering **CASE Tools:** What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The Integration Architecture, The CASE Repository.

### **Recommended Books**

1. Software Engineering, R. Pressman, McGraw-Hill.
2. Software Engineering, K.K. Agrawal and Y. Sing, New Age International.
3. Software Project Management in Practice, P. Jalote, Pearson.

## **MCA-T204 Computer Networks**

### **UNIT I**

Introduction: Overview of Networks, Circuit switching to packet switching principles, Protocols, protocol architecture, Reference Models, TCP/IP Model. Design Issues for the layers.

### **UNIT II**

#### **Physical Layer:**

Concepts of Frequency, Spectrum, bandwidth. Wireless and Wired Transmission Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission: Microwave, satellite communication etc.

### **UNIT III**

#### **DLL**

Data Encoding: Introduction, Block coding, cyclic codes, checksum, framing, Noiseless channels, noisy channels, Asynchronous and Synchronous transmission, Full and Half duplex, Encoding schemes : BCA (NRZ, Bipolar AMI, B8ZS, HDB3, ASK, FSK,PSK,PCM,AM,FM,PM),

Data Link Control: Flow control: Stop and Wait, Sliding window, Error detection: Parity

Check, CRC. Error control: Stop and Wait ARQ, Go back-N ARQ, Selective-Reject ARQ, Brief idea of HDLC and other Data Link control protocols

## **UNIT IV**

### **Network layer**

Logical addressing, internetworking, address mapping, LAN Technology: LAN architecture, IEEE 802 standards, Ethernet (CSMA/CD): Medium Access Control, Ethernet, Fast Ethernet, Brief survey of other LAN systems (Token ring, FDDI, ATM, Fiber channel). Wireless LANS, Bridges, Latest trends in LAN technologies LAN Devices: Study of specifications of L2 and L3 switches. IPv4, IPv6, IP multicasting. Routing protocols.

Principles of routing. Link-state and distance vector routing

## **UNIT V**

### **Transport Layer**

Process to process delivery, UDP and TCP protocols, SCTP, data traffic, congestion, congestion control,

Application Layer : Principles of Internetworking, connection less Internetworking, HTTP, WWW, FTP, SMTP, SNMP, and MIME POP3, DNS, Firewall and Gateways etc.

### **Recommended Books**

1. Data & Communications, William Stallings, Prentice Hall,
2. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill Education,
3. Computer Networks, A. S. Tanenbaum, Prentice-Hall,
4. Computer networks and internets, Douglas Comer, Prentice Hall

## **MCA-T205**

## **Computer Architecture**

### **UNIT I**

#### **Processor Basics**

Processor Basics: CPU Organization: Fundamentals, additional features. Data representation: Basic formats, fixed point numbers, floating-point numbers. Instruction sets: Instruction formats, instruction types, programming considerations.

### **UNIT II**

#### **Data path Design**

Data path Design: Fixed point arithmetic- Addition and subtraction, multiplication, division. Arithmetic Logic Unit: Combinational ALUs, sequential ALUs. Advanced topics: Floating-point arithmetic, pipeline processing.

### **UNIT III**

#### **Control Design**

Control Design: Basic concepts: Introduction, hardwired control, design examples. Micro-programmed control: Basic concepts, multiplier control unit, CPU control unit. Pipeline control: Instruction pipelines, pipeline performance, super-scalar processing.

### **UNIT IV**

#### **Memory Organization**

Memory Organization: Memory technology: Memory device characteristics, random-access memories, serial-access memories. Memory systems: Multilevel memories, address translation, memory allocation. Caches: Main features, address mapping, structure versus performance.

### **UNIT V**

#### **System Organization**

System Organization: IO and System Control: Programmed IO, DMA and interrupts, IO processors. Parallel processing: Processor-level parallelism, multiprocessors.

### **Recommended Books**

1. Computer Architecture and Organization, J.P. Hayes: McGraw-Hill International
2. Computer Architecture: A Quantitative Approach, J. L. Hennessy, David A. Patterson  
Morgan Kaufmann
3. Computer Organization and Architecture, William Stallings, Pearson.
4. Advanced Computer Architecture, Kai Hwang, McGraw-Hill
5. Computer Organization and Architecture: Designing for Performance, William Stallings,  
Pearson Education Limited

**MCA-E206**

**Department Elective I**

**MCA-E206-1**

**Content Management and Web Development**

### **UNIT I**

Overview of Content Management System (CMS), Features, advantages and disadvantages, WordPress – installation, dashboard, – general settings, creating post, editing post, previewing and publishing post, creating page, editing page, previewing and publishing page,

### **UNIT II**

Adding Images & Managing Media Library: Adding an Image to a Post or Page, Editing Images (Resizing, Cropping, & Rotating), Media Settings (Customizing of Thumbnail size, Medium, & Large), Adding a Featured Image, Uploading Images & Files Directly Into the Media, Library Editing & Deleting Images in the Media Library.

### **UNIT III**

Theme and its customization, activating theme, working with links, customize a site by adding widgets, Create and format posts to a blog site, Categorize and tag posts, Utilize advanced formatting features to add URLs and graphics, Add plug-ins to a Word Press site.

### **UNIT IV**

Introduction to Website hosting and developing content for social media platforms such as wiki and blog; e-publications and virtual reality, e-learning platform such as Moodle, overview of Drupal and Joomla

### **UNIT V**

Web site design using Bootstrap Framework, Advantages and features, Responsive web page, setting up Environment, Bootstrap Grid, Container, Typography, Tables, Form Layout, Button and plugins

### **Recommended Books:**

1. WordPress 5 Complete: Build beautiful and feature-rich websites from scratch, 7th Edition, Karol Krol
2. WordPress 5 Cookbook, Rakhitha Nimesh Ratnayake, Packt Publishing

## **MCA- E206-2**

## **Cloud Computing**

### **UNIT I**

Introduction Cloud Computing: Definition, Types of Clouds, Layer & Services models, Deployment models, Cloud Computing Architecture & infrastructure: Cloud Reference Model, Virtualization: Definition, Types of virtualizations (Compute, Network, Storage), Types of Hypervisor

### **UNIT II**

Cloud Platforms in Industry: Major vendors and their offerings, Introduction to Microsoft Azure, Amazon web services (EC2, S3, Etc.), Google AppEngine. Integration of Private and Public Clouds

Cloud applications: Protein structure prediction, Data Analysis, Satellite Image Processing, CRM and ERP, Social networking. Cloud Application- Scientific Application, Business Application.

### **UNIT III**

Advance Topic in Cloud Computing: Cloud Security, Risks and Approaches of Migration into Cloud. Federated Cloud/ Intercloud, Third Party Cloud Services, Business Continuity and Disaster Recovery, Service Level Agreement (SLA), Dynamic resource provisioning and management, Server consolidation and placement policies, Energy efficiency in data centers, Elastic Load Balancing and Auto Scaling.

### **UNIT IV**

Storage Network Design: Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations.

Techniques for Big data processing (Google GFS, BigTable, and Map-Reduce Hadoop Distributed File System (HDFS), HIVE).

### **UNIT V**

Consensus in Cloud Computing: Issues in consensus, Consensus in synchronous and asynchronous system, Byzantine Agreement: Agreement, Faults, Tolerance, Measuring Reliability and Performance, SLIs, SLOs, SLAs, TLAs, Byzantine failure, Byzantine Generals Problem, Failures & Recovery Approaches in Distributed Systems, Checkpointing.

## **Recommended Books**

1. Distributed and Cloud Computing, Kai Hawang, Geoffrey C.Fox, Jack J. Dongarra Elsevier
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing, Kumar Saurabh, Wiley Pub
4. Cloud Security, Krutz, Vines, Wiley Pub
5. Cloud Computing- A Practical Approach, Velte, TMH

## **MCA- E206-3**

## **Real Time Systems**

### **UNIT I**

Introduction to Real-time systems, Issues in Real-time Systems, Real-time System Components, Classification of Real-time systems and Real-time tasks, Misconceptions about Real-time computing. Real-time System requirements: Speed, Predictability, reliability, adaptability, Specification of timing constraints.

### **UNIT II**

Real-time scheduling: Requirements and Issues, Terminology, modeling, Introduction to static and dynamic scheduling schemes, cyclic scheduling, Schedulability tests.

### **UNIT III**

Priority driven scheduling of periodic tasks, Scheduling a periodic tasks, mixed task scheduling, aperiodic task scheduling: fixed priority server/non-server based scheduling algorithms.

### **UNIT IV**

Task Synchronization: Need and priority inversion problem, Priority Inheritance protocol, priority ceiling protocol and stack-based priority ceiling protocol for fixed priority preemptive system.

### **UNIT V**

Introduction to multiprocessor real-time systems, problems and issues. Fault tolerant real time system design: types of faults, causes, detection techniques, mitigation techniques, reliability evaluation, Examples of a real-time operating system

## **Recommended Books**

1. Real-Time Systems, J.W.S.Liu, Pearson Education Asia
2. Real-time system Design, S.T.Lavi, A.K.Agrawala: McGraw Hill
3. Real-time Systems Design and Analysis, P.A.Laplante, An Engineer's Handbook, IEEE Press

4. Real-time Microcomputer System Design An Introduction, P.D.Laurence, K.Mauch,  
McGraw Hill

## **MCA- E206-4**

## **Business intelligence in ERP System**

### **UNIT I**

Business Intelligence an Introduction: Introduction, Definition, History and Evolution, Business Intelligence Segments, Difference between Information and Intelligence, Defining Business Intelligence Value Chain, Factors of Business Intelligence System, Real time Business Intelligence, Business Intelligence Applications Business Intelligence Essentials: Introduction, Creating Business Intelligence Environment, Business Intelligence Landscape, Types of Business Intelligence

### **UNIT II**

Business Intelligence Types: Introduction, Multiplicity of Business Intelligence Tools, Types of Business Intelligence Tools, Modern Business Intelligence, the Enterprise Business Intelligence, Information Workers

Architecting the Data: Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM).

### **UNIT III**

Introduction to Data Mining: Introduction, Definition of Data Mining, Data mining parameters, How Data Mining works, Types of relationships, Architecture of Data Mining, Kinds of Data which can be mined, Functionalities of Data Mining, Classification on Data Mining system, Various risks in Data Mining, Advantages and disadvantages of Data Mining, Ethical issues in Data Mining, Analysis of Ethical issues, Global issues

### **UNIT IV**

Business Intelligence Issues and Challenges: Introduction, Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development

methodology, Planning the BI Projects, Business Analysis and Data Standardization, affect of

Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution

## **UNIT V**

Business Intelligence Strategy and Road Map: Introduction, Planning to implement a Business Intelligence Solution, Understand Limitations of Business Intelligence, Business Intelligence Usage, How to make the best use of Business Intelligence?, The Advantages of BI with Sales, How can BI be used for the rescue?, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership

### **Recommended Books**

1. Business Intelligence And Analytics by Efraim Turban and Ramesh Sharda, PEARSON
2. ERP Systems by, Dimpi Srivastava, Aarti Batra , Dreamtech Press WILEY

## **MCA- E206-5**

## **Image Processing**

### **UNIT I**

**Image presentation and transform:** Elements of visual perception, color representation, Image capture, representation and storage. Gray level transformation, histogram equalization, multi-image operations.

**Image transform:** Discrete Fourier transforms (DFT), Discrete cosine transform (DCT), Walsh-Hadamard transform, Haar transform, Karhunen-Loeve transform, singular value decomposition.

### **UNIT II**

**Image enhancement:** Contrast Intensification, linear stretching, Non-linear stretching, histogram specification, modifying gray level co-occurrence matrix, smoothing, image averaging, mean filter, order statistic filter, edge preserving smoothing, low pass filtering, Image sharpening, high pass filtering, homomorphism filtering.

### **UNIT III**

**Image restoration:** Mean square error restoration, least-square error restoration, restoration by singular value decomposition, restoration by maximum a posterior estimation, restoration by homomorphic filtering, distortion model and range of parameter, filtering procedure and related problems.



## **UNIT IV**

**Image compression:** Fidelity criteria, run length coding, Huffman coding, LZW, arithmetic coding, JPEG encoder and decoder, vector quantization compression.

## **UNIT V**

**Image segmentation:** Region extraction, pixel based approach, multilevel thresholding, local thresholding, region based approach, growing, splitting, merging, split and merge techniques.

### **Recommended books**

1. Digital Image processing and analysis, B. Chandra and D. Majumder
2. Fundamental of digital image processing, Anil K. Jain

## **MCA- E206-6**

## **Mobile Computing**

### **UNIT I**

Basic of mobile technology & smart client Mobile Devices - Definition, m-commerce, m-business, component of wireless environment, wireless communication, mobile device classification, Wireless Network -WPANS, WLAN, WWANS (1 G, 2G, 2.5G, 3G) Introduction to Mobile Communications and Computing, Mobile Computing, novel applications, limitations and architecture Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, security in MANETs.

### **UNIT II**

Cellular concept and its initial implementations The cellular concept, Multiple access technologies for cellular systems, Cellular system operation and planning (General principles, System Architecture, Location updating and call setup), Handoff and power control Initial implementations of the cellular concept: The AMPS system, TACS system, NMT system, NTT system, Concluding remarks.

### **UNIT III**

Digital cellular mobile systems Introduction, GSM: The European TDMA digital cellular standard, GSM standardization and service aspects GSM reference architecture and function partitioning, GSM radio aspects, Security aspects, GSM protocol model, Typical call flow sequences in GSM, Evolutionary directions for GSM IS-136, The North American TDMA digital cellular standard(D-AMPS), Background on North American digital cellular, Service aspects of D-AMPS(IS-136), Network reference, Radio aspects, Security aspects, Protocol model and typical

flow sequences, Evolutionary directions

#### **UNIT IV**

Mobile data communications Introduction, Specialized packet and mobile radio networks, Circuit switched data services on cellular networks, circuit switched data on analog cellular networks, Circuit switched data on digital cellular networks, high speed Circuit switched data in GSM, Packet switched data services on cellular networks, Packet data in analog cellular networks, CDPD (cellular digital packet data), Packet data in digital cellular

Evolution of cellular mobile data capabilities: The EDGE concept, Data over lower power wireless or cordless telecommunication networks, Data services over DECT(Digital enhanced cordless telecommunications), Data services in PACS(Personal Access communications System), Data services in PHS(Personal Handy phone system), Data services in CT2 (Cordless Telephony 2)

#### **UNIT V**

Android Basic & Its components Introduction to Android -History of android, The Open Handset Alliance, Android SDK installation, Android SDK & their codenames, Advantages of android, The Android O/S Architecture, Over view of IDE for Android application, AVD, launching and starting AVD (android virtual device) Managing Application Resources -What are resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus) Android Application Components- Activities & its life cycle, Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter

#### **Recommended Books**

1. Mobile and personal communication systems and Services, By Raj Pandya
2. Mobile communications, By Jochen Schiller Addison-Wesley.
3. Mobile Computing, By Talukder Yavagal
4. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley.
5. Android Application Development by Rick rogers, John Lombardo,O'Reilly Professional
6. Android 2 application development by Reto Meier –Wrox

**MCA-P201****Minor Project**

Students can get acquainted with the concept of Web development/ mobile development/ software project development

**MCA-P202****JAVA Programming Lab**

The faculty offering the course can adopt variations in tune with subject.

## M.C.A. SEMESTER – III

**MCA-T301**

### **Artificial Intelligence and Machine Learning**

#### **UNIT I**

Overview of AI, Problems, Problem space and searching techniques, Definition- production system, Control strategies- forward and backward chaining, Heuristic search techniques-Hill Climbing, Breadth first Search, A\* algorithm, AND/OR Graphs, Knowledge representation-First Order predicate logic, Resolution Principles and unification, Horn clause

#### **UNIT II**

**Neural Architecture:** Neuron model, transfer function, hamming and Hopfield network, perceptron: Linear Separability, learning rule. Back propagation: generalized delta rule, limitations, Neural network applications: Pattern classification, function approximation

**Expert System:** Introduction, Component, development process. Learning, Planning and Explanation in Expert Systems, Study of existing expert systems: MYCIN & AM.

#### **UNIT III**

**Machine Learning:** Learning, Types of Machine Learning, Learning: Supervised, associative, competitive, unsupervised learning. Unsupervised learning: Self-organizing maps, Adaptive Resonance Theory

#### **Linear Models**

Bayesian Networks, Reinforcement Learning, Multi-layer Perceptron, Forwards and Backwards Propagation, Error, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machines.

#### **UNIT IV**

#### **Tree and Probabilistic Models**

Learning with Trees, Decision Trees, Constructing Decision Trees, Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms, Vector Quantization.

#### **UNIT V**

#### **Dimensionality Reduction and Evolutionary Models**

Dimensionality Reduction, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Least Squares Optimization, Markov Decision Process

## **Recommended Books**

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig. Prentice Hall,
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Building Expert Systems, Jackson, John Wiley
5. Machine Learning, C. Bishop T. M. Mitchell, McGraw-Hill
6. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

## **MCA-T302**

## **Digital marketing**

### **UNIT-I**

#### **Introduction to Digital Marketing:**

Importance of digital marketing, Difference between traditional and digital marketing, recent trends and current scenario of the industry, Case studies on digital marketing strategies

#### **Website Planning and Creation:**

Adding content, install and activate plug-in, incorporate design elements to website.

### **UNIT-II**

#### **Search Engine Optimization (SEO)**

various search engines and their algorithms, various to make a website rank ,different aspects of SEO like on-page and off-page optimization, keywords research, meta tags, meta description, link building and more.

### **UNIT-III**

#### **Search Engine Marketing**

Advertisement Strategies, SEM activities via Google Ads platform, Google Keyword Planner, search volume, cost-per-click (CPC), and customer lifetime value (CLV) and other such metrics.

### **UNIT-IV**

#### **Social Media Marketing**

Marketing on Paid advertisements on social media platforms like Facebook, Instagram, Effective

social media strategies on platforms such as Facebook, Twitter, Google+, Snapchat etc, building a social media campaign, write ad copies and ad creatives., case studies on social media strategies

## **UNIT-V**

Web Analytics, Digital Media Planning and Buying, Web Remarketing, Email Marketing, Mobile Marketing, E-Commerce Management, Content Strategy, Ad sense, Blogging and Affiliate Marketing

### **Recommended Books**

1. Fundamentals of Digital Marketing by Puneet singh Bhatia, PEARSON
2. Digital Marketing: From Fundamentals to Future Paperback by Swaminathan T. N./Karthik Kumar, Cengage publications

## **MCA-T303**

## **Embedded Systems**

### **UNIT I**

#### **Overview and General Purpose Processor**

**Overview:** Overview of embedded systems, Design challenges, common design metrics, processor technologies: general purpose processors, single-purpose processors, application specific

Instruction set processors, IC technologies- full custom/VLSI, semicustom ASIC, PLD, Design Technologies- compilation/ synthesis, libraries/ IP, test/ verification.

**General-Purpose Processors:** Basic architecture, data path, control unit, memory, operation, instruction execution, pipelining, superscalar and VLIW architectures, programmers view, instruction set, program and memory data space, registers, I/O, interrupts, development environment, design flow and tools, debugging and testing, selecting a microprocessor.

### **UNIT II**

#### **Custom Processors**

Custom-Single purpose processors: Custom single purpose processor design, optimizing custom single processors. Standard single-purpose processors: peripherals Timers, counters, watchdog timers, UART, Pulse width modulator, LCD controller, Keypad controller, ADC, Real time clocks.

### **UNIT III**

#### **Application Specific Instruction Set Processors**

Application Specific Instruction Set Processor (ASIP) Design: ASIP Design methodologies, steps involved in ASIP design: application analysis, design space exploration, generation of software tools like compiler, debugger, instruction set simulator etc., and synthesizing processor. Simulation based and scheduler based design space exploration techniques and their comparison.

#### **UNIT IV**

##### **Memory and Interfacing**

**Memory:** Memory write ability and storage performance, Common memory types, composing memories, memory hierarchy and cache, advanced RAM: DRAM, FPM DRAM, EDO DRAM, SDRAM, RDRAM, Memory management Unit.

**Interfacing:** Arbitration, Multi-level bus architectures, Serial protocols: I2C bus, CAN bus, Fire Wire bus, USB, Parallel protocols: PCI and ARM bus, Wireless Protocols: IrDA, Bluetooth, IEEE802.11.

#### **UNIT V**

##### **Case Study**

Case study of embedded system (Digital Camera): Introduction to a simple digital camera- user's perspective and designer's perspective, requirements specification- non functional requirements, informal functional specification, refined functional specification. Design alternatives- microcontroller alone, microcontroller and CCDPP, microcontroller and CCDPP/ Fixed-Point DCT, microcontroller and CCDPP/DCT.

##### **Recommended Books**

1. Frank Vahid & Tony Givargis: Embedded system design: A unified hardware/software Introduction, John Wiley & Sons Inc. 2002.
2. Denial D. Gajski, Frank Vahid: Specification and design of embedded systems, PH
3. Jonathan W. Valvano: Embedded Microcomputer Systems, Thomson Learning
4. Myke Predko: Programming and Customizing the 8051 Micro Controller, TMH
5. Ayala: 8051 Micro controllers, Penram Press

## **MCA-T304 Information Systems and Cyber Security**

#### **UNIT I**

##### **Security Essentials**

Introduction, Elements of Information security, Security Policy, Techniques, steps, Categories,

Operational Model of Network Security, Basic Terminologies in Network Security.

## **UNIT II**

### **Cyber Crime**

Concept of Cyber Crimes, Categories of cyber crime, Types of Cyber crimes, Viruses, worms, software piracy, Web jacking, Web Defacement, Cyber Stalking, Cyber Pornography, Hacking, Phishing, e-fraud, threatening email, Cyber Terrorism.

## **UNIT III**

### **Cyber Laws and Security**

Introduction to Cyber Law, Definition, Objectives of Cyber Law, Need, Scope, Copyright issues in Cyberspace, Data encryption, Cryptography, Digital Signatures, Password, Encrypted smart card, Bio-metric, firewall. Information Security Management System and other Security Compliances, Security Assurance, Security Laws, International Standards, Security Audit, SSE-CMM / COBIT etc

## **UNIT IV**

### **Information Technology Act**

Background of Information Technology Act 2000, Preliminary, Definitions, amendments, Authentication of electronic records, Legal recognition of electronic records, Legal recognition of digital signatures, Attribution, Regulation of Certifying Authorities, Acknowledgment and Dispatch of electronic records, Secure records and secure digital signatures, Functions of controller, Duties of Subscribers, Penalties and Offences.

## **UNIT V**

### **Intellectual Property Rights**

Introduction, objectives of copyright, Requirement and meaning of copyright, copyright as a bundle of rights, Framing, Linking and Infringement, Information Technology act related to copyright, Linking and Infringement, information Technology act related to Copyright

### **Recommended Books**

1. Cyber Laws, Dr Gupta & Agrawal, Premier publishing Company
2. Cyber Law simplified, Vivek Sood, Tata MaGraw-Hill
3. Nature of Cyber Laws, S.R. Sharma, Anmol Publications
4. Dimensions of Cyber Crime, S.R. Sharma, Anmol Publications
5. Computer Forensics & Cyber Crimes , Marjie Britz , Pearson.
6. e-Commerce - Concepts, Models, Strategies, C S V Murthy, Himalaya Publishing House



## **Departmental Elective(s)-II**

### **MCA- E305-1**

### **Software Testing**

#### **UNIT I**

Software Testing: Introduction, Importance, Fundamental Principles of Testing SDLC Vs STLC, Manual Testing, Automation Testing, Automated Testing Vs. Manual Testing, Unit Testing, Integration Testing, System Testing, Smoke and Sanity Testing, Regression Testing, Non-Functional Testing

#### **UNIT II**

Introduction to Test Formality, Test Scenario, Test Case Specifications, Test Basis, Traceability Matrix, Software Testing Techniques, Equivalence Partitioning & Boundary Value Analysis, Decision Table Testing, State Transition Diagram, Use Case Testing, Test Management & Control Estimation, Test Plan

#### **UNIT III**

Defects, Defect Life Cycle, Testing Tools, Agile, Agile Testing Methodology, Scrum Testing, Automation Testing for Agile Methodology, Scaled Agile Framework(SAFe), Waterfall Vs. Agile, Agile Vs Scrum, Scrum Vs. Kanban,

#### **UNIT IV**

WhiteBox Testing: Loop Testing, Path Testing, Condition testing , Memory Testing  
Blackbox Testing: Functional Testing, Integration Testing, System Testing, Acceptance Testing, Smoke Testing, Exploratory Testing, Ad hoc Testing.

#### **UNIT V**

Performance Testing, Load Testing, Stress Testing, Volume Testing, Scalability Testing, Soak Testing, Stability Testing, Spike Testing, Performance Testing vs. Load Testing vs. Stress Testing, Globalization Testing, Compatibility Testing, Static Testing, Cyclomatic Complexity, Testing as a Service (TaaS), Test Maturity Model (TMM)

### **Recommended Books**

1. The Art of Software Testing, Glenford Myers , Wiley
2. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin, Pearson Education
3. Software Testing: Principles and Practice, Gopalaswamy Ramesh and Srinivasan Desikan,

Pearson Education

4. Software Testing: A Craftsman's Approach, Paul Jorgensen, CRC Press.

## **MCA- E305-2**

## **Robotics**

### **UNIT I**

#### **Introduction**

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems Hydraulic, Pneumatic and Electric system.

### **UNIT II**

#### **End Effectors and Robot Controls**

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

### **UNIT III**

#### **Robot Transformations and Sensors**

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot, Touch sensors-Tactile sensor, Proximity and range sensors, Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

### **UNIT IV**

#### **Robot Cell Design and Applications**

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions- Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

### **UNIT V**

#### **Micro/Nano Robotics System**

Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano

grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

### **Recommended Books**

1. Robotics Technology and flexible automation, S.R. Deb, Tata McGraw-Hill Education.
2. Industrial Robotics, Technology programming and Applications, . Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, McGraw Hill.
3. Robotics Engineering an Integrated Approach, Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Phi Learning.
4. Engineering foundation of Robotics, Francis N. Nagy, Andras Siegler, Prentice Hall Inc.
5. Robotics and Image Processing an Introduction, P.A. Janaki Raman, Tata McGraw Hill Publishing company Ltd.

## **MCA- E305-3**

## **Internet of Things**

### **UNIT I**

**Introduction to IoT:** Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

### **UNIT II**

**IoT Architecture** M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

### **UNIT III**

#### **IoT Protocols**

Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Unified Data Standards, Protocols, IEEE 802.15.4, BACNet Protocol, Modbus– Zigbee Architecture, Network layer, 6LoWPAN - CoAP - Security

### **UNIT IV**

#### **Building IoT With Raspberry Pi & Arduino**

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python, IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

## **UNIT V**

### **Case Studies and Real-World Applications**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT, Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

### **Recommended Books**

1. Internet of Things, A hands-on approach Arshdeep Bahga, Vijay Madiseti, Universities Press,
2. Architecting the Internet of Things Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Springer.
3. The Internet of Things in the Cloud: A Middleware Perspective Honbo Zhou, CRC Press.
4. The Internet of Things, Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley.

## **MCA- E305-4**

## **Compiler Design**

### **UNIT I**

Introduction to translators, compilers, interpreters, compilation process. Programming language grammars, derivations, reductions, regular expression, context free language and grammar.

Lexical analyzer, input buffering, specification and recognition of tokens, introduction to finite automata, regular expressions to NFA, minimization of DFA, keywords and reserve word policies, LEX, the lexical analyzer generator.

### **UNIT II**

Syntax analyzer, context free grammars, top down parsing, brute force parser, recursive descent parser, LL(1) parser, Bottom up parsing, operator precedence parsing, simple precedence parsing, LR parser, LALR parser, YACC, the parser generator.

### **UNIT III**

Syntax directed translation schemes, implementation of syntax directed translators, synthesized attributes, inherited attributes, dependency graph, evaluation order, construction of syntax trees, directed acyclic graph of expression, bottom up evaluation of S- attributed definitions, L attributed definitions, top down translation of L - attributed definitions.

### **UNIT IV**

Errors, lexical phase errors, syntactic phase errors. Intermediate languages, postfix notation, syntax trees, parse trees, three address code, triples and indirect triples. Translation of assignment statements, Symbol tables, operation on symbol tables, and symbol table organization for non-block structured languages, symbol table organization for block, structured languages.

## **UNIT V**

Run time storage management, storage allocation and referencing data in block structured language, storage allocation. Code optimization, sources of optimization, loop optimization, DAG and optimization of basic blocks. Code generation, a machine model, next use information register allocation and assignment, a simple code generator, code generation from DAG's, Peephole optimization.

### **Recommended Books**

1. Compilers, Principles, techniques and tools, Aho, Ullman and Sethi, Pearson Education.
2. The Theory and Practice of Compiler Writing, Tremblay, Sorenson, BSP.
3. Compiler Design in C, Holub, PHI.

## **MCA- E305-5**

## **Bio-Informatics**

### **UNIT I**

#### **Introduction**

Need for Bioinformatics technologies, Overview of Bioinformatics technologies Structural bioinformatics, Data format and processing, Secondary resources and applications, Role of Structural bioinformatics - Biological Data Integration System.

### **UNIT II**

#### **Data warehousing and Data mining In Bioinformatics**

Bioinformatics data, Data warehousing architecture, data quality, biomedical data analysis, DNA data analysis, Protein data analysis, Machine learning, neural network architecture and applications in bioinformatics

### **UNIT III**

#### **Modeling for Bioinformatics**

Hidden Markov modeling for biological data analysis, Sequence identification –Sequence classification, multiple alignment generation, Comparative modeling –Protein modeling, genomic modeling, Probabilistic modeling, Bayesian networks, Boolean networks - Molecular modeling,

Computer programs for molecular modeling.

#### **UNIT IV**

##### **Pattern Matching and Visualization**

Gene regulation, motif recognition, motif detection, strategies for motif detection, Visualization, Fractal analysis, DNA walk models, one dimension, two dimension, higher dimension, Game representation of Biological sequences, DNA, Protein, Amino acid sequences.

#### **UNIT V**

##### **Microarray Analysis**

Microarray technology for genome expression study, image analysis for data extraction, preprocessing, segmentation, gridding, spot extraction, normalization, filtering, cluster analysis, gene network analysis, Compared Evaluation of Scientific Data Management Systems, Cost Matrix, Evaluation model - Benchmark - Tradeoffs

##### **Recommended Books**

1. BioInformatics Technologies, Yi-Ping Phoebe Chen (Ed), Springer Verlag.
2. BioInformatics, Managing Scientific data, Zoe Iacox and Terence Critchlow, Elsevier.
3. Bio Informatics Computing, Bryan Bergeron, Pearson Education.
4. Introduction to Bioinformatics, Arthur M Lesk, Oxford University Press.

#### **Departmental Elective(s)-III**

##### **MCA- E306-1**

##### **Ethical Hacking and Digital Forensics**

#### **UNIT I**

Computer network and defense fundamentals, Network security threats, vulnerabilities, attacks. Overview of the Top 20 OWASP Security vulnerabilities. CVSS Scoring system including VAPT techniques.

#### **UNIT II**

Network security controls, protocols, and devices, Network security policy design and implementation, Physical security, Host security, Secure firewall configuration and management, Secure IDS configuration and management, Secure VPN configuration and management

Wireless network defense, Network traffic monitoring and analysis, Network risk and vulnerability management, Data backup and recovery, Network incident response and management,

### **UNIT III**

Ethical hacking, Foot printing and reconnaissance, Scanning networks, Enumeration, Sniffing, System hacking, Malware threats, Social engineering, Denial of service, Session hijacking, Hacking web applications, SQL injection, Hacking wireless networks, Hacking web servers, Hacking mobile platforms, Evading IDS, Firewalls, and Honeygot.

### **UNIT IV**

#### **Computer forensics in today's world**

Computer forensics investigation process, Data Acquisition and Duplication, Understanding hard disks and file systems, Defeating anti-forensics techniques, Operating system forensics, Network forensics, Investigating web attacks, Database forensics, Cloud forensics, Malware forensics, Investigating email crimes, Mobile forensics process,

### **UNIT V**

Mobile OS architecture, boot process, and file systems, Mobile threats and security, Forensics report writing and presentation, encryption and steganography analysis. Investigation process: legal process of investigation, jurisdiction and agencies, internet investigation, IP address and domain names, investigation method, evidence collection .

Legal Issues: Constitutional law, search and seizure guidelines, ECPA, challenges in process, international computer crime law.

### **Recommended Books**

1. Hacking for Dummies, Kevin Beaver,Wiley
2. Computer Forensics: Incident Response Essentials, Jay G. Heiser and Warren G. Kruse,Pearson
3. Ethical Hacking and Penetration Testing Guide,Rafay Baloch,CRC Press
4. Handbook of Digital Forensics and Investigation, Eoghan Casey,Elsevier.

## **MCA- E306-2**

## **Data Mining and Data Warehousing**

### **UNIT I**

Database Introduction Database Introduction: Database Management System Concepts and Architecture, Normalization, RDBMS, Concurrency control. Introduction to Data Warehouses, Differences between Operational Database Systems and Data Warehouses, a multidimensional Data

Model, Data Warehouse Architecture, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses,

## **UNIT II**

Conceptual Data Architecture, Logical Architectures-star schema, snowflake, constellation, facttable and dimensions tables, Design Techniques. Data Warehouse Implementation Data Warehouse and OLAP Technology for Data Mining, Data Warehouse and OLAP Technology for Data Mining:, Data Marts, Metadata, OLAP, Categorization of OLAP Tools.

## **UNIT III**

Data Preprocessing(ETL Process): Data Cleaning, Data Integration and Transformation, Data Reduction, Data Mining Primitives, Concept Description, Mining Association Rules and Algorithms.

## **UNIT IV**

Data Mining Methods Data Mining Methods –Correlation Analysis, Classification and Prediction - Basic Concepts, Statistical based classification, Decision Tree Induction, K Nearest Neighbors, Rule Based Classification, Classification by Backpropagation, Support Vector Machines

## **UNIT V**

Clustering and Introduction to Fuzzy Logic Clustering and Introduction to Fuzzy Logic: Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Outlier Analysis, Data Mining Applications. Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicate logic

## **Recommended Books**

1. Fundamentals of Database Systems, Elmasri, Navathe: Addison Wesley, Pearson Education.
2. Data Warehousing, Data Mining & OLAP, Alex Berson and Stephen J. Smith, Tata McGraw,Hill
3. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Elsevier.
4. Introduction To Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Person Education.
5. Insight into Data mining Theory and Practice, K.P. Soman, Shyam Diwakar and V. Ajay, Prentice Hall of India.
6. Introduction to Data Mining with Case Studies, G. K. Gupta,Prentice Hall of India.



## **MCA- E306-3**

## **Soft Computing**

### **UNIT I**

#### **Introduction:**

Definition of Soft Computing, Conception of Soft Computing, Importance of Soft Computing, The Soft Computing – development history. Difference between Hard and Soft computing, Requirement of Soft computing, Major Applications Areas of Soft Computing.

### **UNIT II**

#### **Neural Networks**

Neural Network, Applications of ANN, Learning rules and various activation functions, Single layer Perceptron's, Back Propagation networks, Architecture of Back propagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

### **UNIT III**

#### **Fuzzy Systems**

Introduction to Fuzzy logic, Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification, Fuzzy membership functions, Operations on Fuzzy sets. Fuzzy relations, Fuzzy proposition, Fuzzy implications, Fuzzy inferences Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method.

### **UNIT IV**

**Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Solving optimization problems, Multi-level Optimization.

### **UNIT V**

Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them. Multi-Objective Evolutionary Algorithm (MOEA). Recent Trends in various classifiers, Swarm Optimizations algorithms : ant colony , Bee colony. Introduction to basic Particle Swarm Optimization (PSO) algorithm – Swarm intelligence.

#### **Recommended Books**

1. Genetic Algorithm in Search Optimization and Machine Learning, David E. Goldberg, Pearson Education India.

2. Neural Networks Comprehensive Foundation, Simon Haykin, Pearson Education.
3. Fuzzy Logic: A Practical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
4. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
5. Principles of Soft Computing, S.N.Sivanandam and S.N.Deepa, Wiley India Pvt Ltd.
6. Clerc, Maurice, "Particle swarm optimization", John Wiley & Sons, 2010.

## **MCA- E306-4**

## **Ad Hoc Networks**

### **UNIT I**

#### **Introduction**

Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum –Radio propagation Mechanisms, Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

### **UNIT II**

#### **Mac Protocols for Ad Hoc Wireless Networks**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention Based Protocols -Reservation and Scheduling Mechanisms - Other Protocols. Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms –Multi channel MAC-IEEE 802.11

### **UNIT III**

#### **Routing Protocols and Transport Layer in Ad Hoc Wireless Networks**

Design Issues and Classifications of unicast and multicast Routing Protocols - proactive routing, reactive routing (on-demand), hybrid routing protocols, Energy Efficient and QoS guaranteed multicast protocols.

### **UNIT IV**

**Routing Protocol:** Global State Routing (GSR), Dynamic State Routing (DSR), Fisheye State Routing (FSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance, Vector routing (DSDV). Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

## **UNIT V**

### **Wireless Sensor Networks (WSNS) and Mac Protocols**

Single node architecture: hardware and software components of a sensor node, WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

### **Recommended Books**

1. Ad Hoc Wireless Networks, C. Siva Ram Murthy and B.S. Manoj
2. Ad Hoc Mobile Wireless Networks: Protocols and Systems, C.K. Toh, Prentice Hall PTR,
3. Ad Hoc Networking, Charles E. Perkins, Addison Wesley,
4. Wireless Communications: Principles and Practice, T.Rappaport, Prentice Hall,
5. Principles of Wireless Networks, K. Pahlavan & P. Krishnamurthy, Prentice Hall

## **MCA- E306-5**

## **Natural Language Processing**

### **UNIT I**

#### **Overview and Language Modeling**

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

### **UNIT II**

#### **Word Level and Syntactic Analysis**

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

### **UNIT III**

#### **Semantic Analysis and Discourse Processing**

Semantic Analysis: Meaning, Representation, Lexical, Semantics, Ambiguity, Word Sense Disambiguation.

Discourse Processing : cohesion-Reference, Resolution, Discourse Coherence and Structure.

### **UNIT IV**

#### **Natural Language Generation and Machine Translation**

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG .

Machine Translation : Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

## **UNIT V**

### **Information Retrieval and Lexical Resources**

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

### **Recommended Books**

1. Natural Language Processing and Information Retrieval, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press.
2. Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Daniel Jurafsky and James H Martin, Prentice Hall.
3. Natural Language Understanding, James Allen, Benjamin /Cummings publishing company,

## **MCA-P301**

### **Embedded System Lab**

The faculty offering the course can adopt variations in tune with subject MCAT303.

## **MCA-P302**

### **Artificial Intelligence and Machine Learning Lab**

The faculty offering the course can adopt variations in tune with subject MCAT301.

# MCA SEMESTER IV

## MCA-P401

## Industry Project

The projects submitted by the candidates will be evaluated as per the following guidelines.

1. Project Title/Topic to be selected by the student after end of 3<sup>rd</sup> semester in accordance with his project guide and the same must be finalized on the commencement of 4<sup>th</sup> semester
2. The project must be of approximately **360** man hours and should be **certified** by the **supervisor** of the project
3. The project must be submitted in the form in consonance with the format enclosed
4. **Monthly progress report** must be **submitted on mail only** through supervisor in the enclosed format.
5. Project must be submitted on and before the prescribed last date.
6. Candidates are required to make a **presentation** of their project work during their project evaluation by examiners.
7. Students whose Projects graded as **unsatisfactory** will **given one more chance** to undertake **another project** under another supervisor.
8. The project work of the candidates whose monthly progress report is not submitted monthly will be considered as incomplete and may be terminated as per the rules.
9. Students are required to **give progress seminar twice** during the project work.
10. Examination of the project work will be conducted by a committee consisting of at least **two internal examiners and one external examiner.**

## **Guidelines for Project in partial fulfillment of the requirement of MCA course**

- (a) The project will consist of two parts:
  - 1. Documentation
  - 2. Viva-voce
- (b) The **source-code** and the **executable** code have to be submitted on CD/DVD and student must **demonstrate** working of the software.
- (c) Project shall be original and **not copied** from the existing material from any source and a certificate, as per format given will be provided with the Project, duly countersigned by the supervisor.
- (d) Project will be submitted only when the candidate completes all papers though he or she may start the projects earlier.
- (e) Presentation of the Project will be in the accepted norms; as laid down in various text-books; IEEE standard/ ISO standards etc., are some models to follow.
- (f) As far as possible, the Project should be of **Real life problem / Social Impact / Commercially viable solution.**
- (g) Though the Project is given **360** hours, the student is expected to use his/her discretion to ensure that it is large enough to be of **practical value.**

## PERFORMA FOR CERTIFICATE

This is to certify that this is a bonafide record of the Project entitled \_\_\_\_\_ was done satisfactory at \_\_\_\_\_ by Mr./Ms.

\_\_\_\_\_ in partial fulfillment of MCA course. He/ She has successfully completed all the subjects.

This report had not been submitted for any other examination and does not form part of any other course undergone by the candidate.

PLACE:

DATE:

SIGNATURE

NAME:

DESIGNATION:

(Name & Seal of Supervisor)

## **PROFORMA FOR THE PROJECT REPORT**

1. Title of the Project
2. Objectives
3. Input to the Project
4. Output generated
5. Details of Hardware Platform used
6. Details of Software Tools used
7. Implementation Issues (Clearly defining the area of Application).
8. Miscellaneous
9. Signature of the Candidature.

## **GUIDELINES FOR THE CHAPTERS AND SECTIONS**

1. Microscopic Summary
2. Details of candidate and Supervisor along with certificates of:
  - Original Work;
  - Assistance if any;
  - Credits.
3. Aims and Objectives
4. Approach to Project and Time Frame
5. Project Design Description with Appendices to cover:
  - Flow Charts/Data Flow Diagram-Macro/Micro level
  - Source Code
  - Hardware Platform
  - Software Tools
  - Security measures
  - Quality Assurance Auditability
6. Test Data and Result.