

**MAHATMA GANDHI UNIVERSITY  
KOTTAYAM**



**MASTER OF COMPUTER APPLICATIONS  
REGULAR (2 YEARS)**

**SCHEME, SYLLABUS & REGULATIONS  
FOR  
AFFILIATED COLLEGES  
(FROM 2020 ADMISSION ONWARDS)**

## Course Content - Semester 1

Course Code	Course Title	Continual Evaluation (Marks)	University Evaluation (Marks)	Total Marks
MCA CT 101	<u>Mathematical &amp; Statistical foundation for Computer Applications</u>	25	75	100
MCA CT 102	<u>Digital Logic &amp; Computer Organization</u>	25	75	100
MCA CT 103	<u>Structured programming in C</u>	25	75	100
MCA CT 104	<u>Software Engineering and Object oriented modeling</u>	25	75	100
MCA CT 105	<u>Database technology and NoSql</u>	25	75	100
MCA CP 106	<u>Database technology Lab(Mysql &amp; Mongodb)</u>	25	75	100
MCA CP 107	<u>Software Development Lab- I (C programming)</u>	25	75	100
MCA CT 108	<u>Employability Skill Training- Phase 1</u>	50	0	50
<b>Total</b>				<b>750</b>

<b>Course Code</b>	<b>Course Title</b>
<b>MCA CT 101</b>	<b>Mathematical &amp; Statistical foundation for Computer Applications</b>

<b>Module No.</b>	<b>Title &amp; Contents</b>
1	<p><b>Set theory:</b> Definition, Types of sets, Set Operations</p> <p>Relations: Definition, Representation of relations as matrices and diagrams, Properties of binary Relations-Reflexive, Symmetric, Transitive, Antisymmetric, Equivalence relations, Partial ordering.</p> <p>Functions: Definition, Injective and Surjective Functions, Composition of functions.</p>
2	<p><b>Mathematical Logic:</b> Introduction, Connectives, Truth tables, Tautology and contradiction, Logical implications equivalence formulas, Inference theory-Validity by truth table, Rules of Inference. Methods of proof- Direct, Indirect and contradiction.</p> <p>Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free and bound variables, the universe of discourse.</p>
3	<p><b>Correlation &amp; Regression:</b> Types of correlation, KPCC, Rank Correlation, Lines of regression, estimation using regression.</p> <p><b>Probability Theory</b>-Random experiments, sample space-Types of events, Addition and multiplication rule, Conditional Probability, Bayes theorem, and its applications</p>
4	<p><b>Random variables</b>- Discrete and continuous- Probability mass and density function – Distribution Function -Joint distributions-Marginal Distributions -Standard Distribution- Binomial, Poisson and Normal Distributions <b>Sampling theory</b>-Population &amp; Sample, Types of sampling-Parameter &amp; Statistics- Sampling Distribution- Central Limit Theorem(Statement only) <b>Theory of Estimation:</b> Basic concepts- Point estimation &amp; Interval Estimation (Just concepts)</p>
5	<p><b>Testing of Hypothesis</b> -Null &amp; Alternate Hypothesis, critical region and level of significance- One-tailed and two-tailed test -Types of errors- procedure for testing hypothesis</p> <p><b>Large sample test</b> - Single mean and difference of means</p> <p><b>Small Sample test</b>- t-test for Single mean and Difference of means, Paired t-test, Single variance, Chi-square test for goodness of fit and Independence of attribute</p>

### Text Books & References

1. Discrete Mathematical Structures with Applications to CS; Tremblery, R.Manohar, TMH
2. Fundamentals of statistics: S.C.Gupta,6thRevised and enlarged edition-April 2004, Himalaya Publications.
3. Discrete Mathematics and Its Applications by Kenneth H Rosen. Tata McGraw-Hill Publications Co. Ltd.
4. Discrete Mathematics, by Kenneth A. Ross, Charles, B. Wright, Pearson Education.; Dorling Kindersley India Pvt. Ltd.
5. Discrete and Combinatorial Mathematics, by Ralph P. Grimaldi and Ramana B. V., Pearson Education.
6. Probability and Statistics, Biswal, Purna Chandra Description: New Delhi PHI Learning Pvt. Ltd. 2007 Edition: 1st ed. : xiii,374p. ISBN: 9788120331402
7. Probability and Statistics. Mendenhall, William; Beaver, Robert J; Beaver, Barbara M Description: New Delhi Cengage Learning India Private Limited

### Learning Outcomes

On completion of the course, the student will be able to

- understand the basics of Set theory, Relations and Functions and their application in the Computer Science field
- apply the Rules of inference to solve applied problems.
- be familiar with the basic concepts of Probability Theory and Sampling Techniques.
- design a Probability model/ test of significance to solve a real-world problem.

Course Code	Course Title
MCA CT 102	Digital Logic & Computer Organization

Module No.	Title & Contents
1	<b>Binary Arithmetic And Binary Codes</b> Binary arithmetic–Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division Representation of signed numbers–Sign magnitude form, Complement form : 2’s complement and 1’s complement method, 2’s complement Arithmetic, 1’s complement Arithmetic Binary Codes - Introduction to 8421 BCD, BCD addition and subtraction, Gray code, Conversion from Binary to Gray and vice versa Error detecting codes: Parity, Check Sum, Block parity Error correcting codes: 7 bit Hamming Code Alphanumeric codes: ASCII, EBCDIC

2	<p><b>Boolean Algebra And Digital Circuits</b></p> <p>Boolean Algebra–Axioms and laws of Boolean algebra with algebraic proof and truth table, Reducing Boolean Expressions: Algebraic method, Karnaugh map method in SOP, POS, Don't care condition (upto 4 variables),</p> <p>Combinational circuits–Adders(Half adder, Full Adder), Magnitude Comparator(1 bit and 2 bit comparator), Multiplexers (2 input, 4 input multiplexer).</p> <p>Sequential circuits - Flip Flops :RS flip-flop, D- flip-flop, JK, T flip-flop(Block diagram, Logic diagram,truth table, Characteristic equation)</p> <p>ShiftRegisters - Serial in serial out, Serial in Parallel out, Parallel in serial out, Parallel in Parallel out shift registers(logic diagram), Bidirectional shift register, Universal shift registers.</p>
3	<p><b>Processing Unit Concepts</b></p> <p><b>Basic structure of computer-</b> Types and Functional Units, Performance :processor clock, Basic performance equation</p> <p><b>Machine Instructions and Programs-</b> Memory Locations and addresses, Byte Addressability, Memory Operations, Instructions and Instruction sequencing,Addressing Modes, Basic Input Output Operations.</p> <p><b>Computer Arithmetic-</b> Fast Adders, Signed Addition and Subtraction, Multiplication of positive numbers,Booth's algorithm,Fast Multiplication, IEEE Representation of Floating point Numbers.</p> <p><b>Processing Unit</b> - Instruction execution cycle, Sequencing of control signals, Hardwired Control, Microprogrammed Control, Control Signals, Microinstructions, Microprogram Sequencing, Branch Address Modification</p> <p><b>RISC:</b> RISC characteristics and CISC characteristics</p>
4	<p><b>Main Memory And I/O Organization</b></p> <p><b>Main Memory</b> - Memory Hierarchy: Main memory, RAM : Semiconductor RAM memories, ROM , Cache Memory, Secondary memory, Performance Considerations, Virtual Memory, Memory Management Requirements,</p> <p><b>Input / Output Organization</b> - Accessing I/O devices, I/O techniques: Program Controlled I/O, Interrupts, Direct Memory Access(DMA</p> <p><b>Interrupts:</b> Interrupt processing, Interrupts Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exception, Use of Interrupts in OS.</p> <p><b>Direct memory access (DMA):</b> DMA operations, Bus Arbitration, Buses, Interface Circuits, Standard I/O Interface: USB.</p>
5	<p><b>Advanced Computer Architecture</b></p> <p><b>Basic Parallel Processing Architecture</b> - Flynn's Classification : SISD, MISD, SIMD, MIMD structures, Classification of Parallel Structures(SIMD) : Array Processors, Vector processors</p> <p><b>Multiprocessors</b>–Structure, Interconnection Networks, Memory Organization</p> <p><b>Pipelining</b> – Basic Concepts of pipelining,Arithmetic pipelining, Instruction Pipelining, Hazards</p> <p><b>Advanced Concepts</b> - Instruction-level parallelism, Superscalar, Superpipelined, Multicore Systems</p>

## Text Books & References

1. Fundamentals of Digital Circuits, A. Anand Kumar, 4<sup>th</sup> Edition, PHI, 2018
2. Digital Logic and Computer Design, Morris Mano, PHI, 2016.
3. Digital Fundamentals, Thomas L. Floyd, Pearson Education, 11<sup>th</sup> edition, 2018
4. Computer Organization, V. Carl Hamacher, Zvonko Vranesic, Safwat Zaky. Mc-Graw Hill International Edition, 5<sup>th</sup> Edition.C
5. Computer Organization and Architecture, William Stallings, Pearson, 10<sup>th</sup> Edition
6. Computer System Architecture, M. Morris Mano, Pearson, 3<sup>rd</sup> Edition
7. Computer Architecture and Parallel Processing by Kai Hwang, Faye A. Briggs, Tata Mc Graw Hill Edition

## Learning Outcomes

At the end of this course, a student will be able

- to do arithmetic operations on binary and understand different binary codes used in communication.
- At the end of the course, students will be able to perform the analysis and design of various digital electronic circuits.
- Students will be able to understand the internal organization of computers, memory units.
- Students will get knowledge about advanced computer architecture.

Course Code	Course Title
MCA CT 103	Structured programming in C

Module No.	Title & Contents
1	<b>Introduction To C:</b> The C Character Set, Identifiers And Keywords, Data Types, Constants, Variables, Declarations, Expressions, Statements. <b>Data Input And Output:</b> Single Character Input, Single Character Output, Scanf, Printf, <b>Operators And Expressions:</b> Arithmetic Operators, Unary Operator, Relational And Logical Operator, Assignment Operators, The Conditional Operator, Type Conversion, Typedef Introduction To Pre-processor Directives.
2	<b>Control Statements:</b> If Else Statement, Switch Statement, Break Statement, Continue Statement, Looping Structures - While Statement, Do-while Statement, For Statement <b>Functions:</b> Defining A Function, Accessing A Function, Function Prototypes, Passing Arguments To A Function, Return Values And Their Types ,Category Of Functions, Recursion, Storage Classes: Automatic Variables, External, Variables, Static Variables, Register Variable

3	<b>Arrays:</b> Defining An Array, Processing An Array, Multidimensional Arrays, Array Operations. <b>Strings:</b> Puts, Gets Function, One Dimensional Character Array, Array Of Strings, Passing 1-d And 2-d Arrays To Functions, String Handling Without Using String Functions.
4	<b>Pointers:</b> Fundamentals, Pointer Declarations, Operations On Pointers, Passing Pointers To A Function, Pointers And One Dimensional Arrays, Pointers And Multidimensional Arrays, Array Of Pointers, Pointers And Strings, Multiple Indirection (Integers, Strings, Pointers To Pointers), Dynamic Memory Allocation (Malloc, Calloc, Realloc, Free). <b>Structures And Unions:</b> Defining A Structure, Processing A Structure, User Defined Data Types, Structure And Pointers, Passing Structure To Function, Self- referential Structures, And Union
5	<b>Data Files:</b> Opening And Closing A Data File, Reading And Writing A Data File, Processing A Data File, File Handling Functions, Formatted Input And Output Functions, File Processing Programs, Concept Of Binary Files.  Additional Features Of C: Enumeration, Bitwise Operators, Command Line Parameters, Macros(Definition, Function Macros, Conditional Macros).

### Text Books & References

1. Schaum's Outline Of Programming With C, Byron Gottfried 4th Edition, Mcgraw-hill
2. Programming In Ansi C, E. Balagurusamy, Eighth Edition, Mcgraw Hill Education.
3. The C Programming Language, Brian W. Kernighan And Dennis M. Ritchie 2nd Edition, Prentice Hall Of India (2015).
4. Computer Basics And Programming In C, Rajaraman V, Phi
5. Understanding Pointers In C, Yashavant Kanetkar ,5th Edition, Bpb Publication (2009)
6. Programming In C, Pradip Dey, Manas Ghosh , 2nd Edition, Oxford Higher Education (2012)

### Learning Outcomes

On completion of the course, the students will be

- Having a deep knowledge in application-oriented C programming features.
- Able to solve problems and implement it using various programming constructs.
- Identify the significance of C language as a very strong programming foundation.

<b>Course Code</b>	<b>Course Title</b>
<b>MCA CT 104</b>	<b>Software Engineering and Object Oriented Modeling</b>

<b>Module No.</b>	<b>Title &amp; Contents</b>
1	<p><b>Introduction to Software Engineering:</b> Definition and characteristics of software, Broad categories of computer software, Software Myths.</p>
	<p><b>The Software process:</b> Software engineering layers, A process framework (five generic process framework and umbrella activities), Software product and software process.</p> <p><b>Process Models:</b> Definition, Waterfall model, Evolutionary models (Prototyping and Spiral models.)</p> <p><b>Agile view of process:</b> Agile process, Human factors in agile models, Agile Process models -(Extreme programming and Scrum).</p>
2	<p><b>Requirements engineering:-</b>Requirements engineering tasks, Initializing requirements engineering process, Types of requirements, Feasibility studies.</p> <p><b>Eliciting requirements:-</b> Interviews, brain storming, FAST, QFD, Use case approach.</p> <p><b>Requirement Analysis:-</b> Steps in requirement analysis, DFD, Data Dictionary, ER diagrams, prototyping, <b>Requirement documentation and review:-</b> Nature of SRS, Characteristics of good SRS, Organization of an SRS-IEEE standard format for SRS(basics only), the requirements review process.</p>
3	<p><b>Software Design:</b> conceptual and technical design, design objectives, importance of design, Modularity (module coupling, module cohesion, relationship between coupling and cohesion), Strategy of design, Function oriented design, Object oriented design(steps to analyze and design object oriented systems.)</p>
4	<p><b>Software Testing:</b> strategic approach: verification and validation, criteria for completion of testing. <b>Test strategies for conventional software:-</b>unit testing, integration testing(Regression testing, smoke testing.), validation testing, system testing(recovery, security, stress, performance). Testing Tactics:- Black box and White box testing, Blackbox- equivalence partitioning, White box-Basis path testing(flow graph notation, deriving test cases)</p>



5	<p><b>Object Oriented Modeling</b></p> <p><b>Use Case:</b> Actors Scenarios &amp; Use cases, drawing Use Case Diagrams, three common use case formats, The system sequence diagram</p> <p><b>UML Interaction diagrams</b> :- sequence and communication diagrams, sequence vs communication diagram, Basic sequence diagram notation, Basic communication diagram notation.</p> <p><b>Class diagrams</b>:-introduction, common class diagram notation.</p> <p><b>Activity Diagrams and Modeling:</b> - Introduction, example, basic activity diagram notation.</p>
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### **Text Books & References**

1. Software Engineering A Practitioner's Approach, Roger S Pressman, McGrawhill International Edition, Sixth Edition.[ Unit 1 and 4]
2. Software Engineering, K K Agarwal and Yogesh Singh, New age international, Third Edition[Unit 2 and 3]
3. Applying UML and Patterns, Craig Larman, Pearson, Third Edition[ Unit 5]
4. Object Oriented modeling and Design with UML, Michael Blaha, James Rumbaugh, Person, second edition.
5. Ian Sommerville, Software Engineering VII th Edition Pearson Education
6. Pankaj Jalote, An Integrated approach to Software Engineering,Narosa Publishing Company, Second Edition.Pearson Education

### **Learning Outcomes**

- At the end of this Course, the participants may get basic insights into the need and importance of software engineering
- After completing this course, the Participants will get familiar with the activities in different phases of software engineering
- After completing the course, the participants will get familiarized with the basics of UML tools used for object oriented modeling

<b>Course Code</b>	<b>Course Title</b>
<b>MCA CT 105</b>	<b>Database Technology and NoSql</b>

<b>Module No.</b>	<b>Title &amp; Contents</b>
1	<p><b>Overview of Database Systems:</b> A Historical Perspective, Files System versus a DBMS, Advantages of a DBMS. Describing and Storing Data in a DBMS : The Relational Model, Levels of Abstraction in a DBMS, Data Independence. Structure of a DBMS.</p> <p><b>Introduction to Database Design:</b> Entities, Attributes and Entity Sets. Relationship and relationship sets. Additional Features of the ER Model.</p>
2	<p><b>Relational Model:</b> Introduction to the Relational Model. Integrity Constraints over Relations: Primary Key, Foreign Key and General Constraints. E-R Model to Relational Model: Entity Sets to Tables, Relationship Sets to Tables, Translating Relationship Sets with Key Constraints. Translating Relationship Sets with Participation Constraints, Translating Weak Entity Sets.</p>
3	<p><b>Structured Query Language:</b> Overview of SQL, Basic Queries in SQL, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, String and Date Functions, Complex Integrity Constraints in SQL, Triggers and Views in SQL, Embedded SQL, Dynamic SQL and Cursors. Relational Database Design Introduction to Schema Refinement, Functional Dependencies, Normal Forms: First Normal Form, Second Normal Form, Third Normal Form, Boyce Codd Normal Form.</p>
4	<p><b>Transaction Management, Concurrency Control, Distributed System</b> - The ACID Properties of a Transaction, Concurrent Execution of Transactions: Serialisability, Anomalies Due to Interleaved Execution, Schedules Involving Aborted Transactions, Lock-Based Concurrency Control: Strict Two-Phase Locking (Strict 2PL), Deadlocks. Introduction to Crash Recovery: Stealing Frames and Forcing pages, overview of ARIES. Dealing with Deadlocks.</p> <p>Introduction to Distributed Database - Distributed DBMS Architectures, Storing data in a Distributed Databases: Replication, Fragmentation.</p>
5	<p><b>Nosql Data Management</b> - Introduction to NoSQL- Four types of NoSQL Databases - Aggregate data models - Aggregates – Key-Value and Document Data Models – Relationships – Graph Databases – Schemaless Databases – Materialized views – Distribution Models – Sharding – Master-Slave Replication – Peer-Peer Replication.</p>

## Text Books & References

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, Third Edition, McGraw Hill, 2003.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Database Systems: Design, Implementation and Management, Peter Rob, Thomson Learning, 7Edn.
4. Concept of Database Management, Pratt, Thomson Learning, 5Edn.
5. Database System Concepts, Silberchatz, Korth and Sudarsan, Fifth Edition, McGraw Hill, 2006
6. The Complete Reference SQL, James R Groff and Paul N Weinberg, Second Edition, Tata McGraw Hill, 2003.

## Learning Outcomes

On successful completion of the course, students will be able to

- Describe the architecture and functioning of Database Management Systems.
- Apply the principles of data modeling using Entity Relationship and develop a good database design.
- Create and maintain a relational database using SQL and its advanced features.
- Apply Normalization techniques to normalize a database.
- Illustrate the techniques for controlling the consequences of concurrent data access and crash recovery.
- Describes how aggregates manifest themselves in data models in NoSQL

Course Code	Course Title
MCA CP 106	Database Technology Lab (Mysql & MongoDB)

Module No.	Title & Contents
1	<b>Building a database: Table by table</b> <ol style="list-style-type: none"><li>a) Table creation with constraints(primary key, referential integrity constraints, not null)</li><li>b) Create Index.</li><li>c) Drop table.</li><li>d) Display a table's structure.</li><li>e) Listing all tables.</li><li>f) Altering the table structure.</li></ol>

2	<p><b>Data manipulation language (DML) commands</b></p> <ul style="list-style-type: none"> <li>a) Row insertion, deletion and updating.</li> <li>b) Save using COMMIT.</li> <li>c) Inserting Table rows with a subquery.</li> <li>d) Restoring table contents (Rollback).</li> </ul> <p><b>Basic SELECT statements</b></p> <ul style="list-style-type: none"> <li>a) Simple select query</li> </ul>
	<ul style="list-style-type: none"> <li>b) Using arithmetic operators in SQL statements</li> <li>c) Selecting rows with conditional restrictions (&gt;, &lt;, =, &lt;&gt;, &gt;=, &lt;=, BETWEEN, IN, LIKE, IS NULL / IS NOT NULL)</li> <li>d) SELECT with Logical Operators (AND, OR and NOT).</li> </ul> <p><b>Advanced SELECT Statements</b></p> <ul style="list-style-type: none"> <li>a) Sorting Data - ORDER BY clause</li> <li>b) Listing Unique Values – DISTINCT</li> <li>c) Aggregate Functions – COUNT, MIN ,MAX SUM ,AVG</li> <li>d) SELECT with GROUP BY &amp; HAVING clause.</li> </ul>
3	<p><b>Joining database tables &amp; SQL Functions</b></p> <ul style="list-style-type: none"> <li>a) Joining Tables <ul style="list-style-type: none"> <li>● Joining tables with an alias.</li> <li>● Cross Join</li> <li>● Natural Join</li> <li>● Join USING</li> <li>● Join ON</li> <li>● The Outer Join (LEFT OUTER JOIN, RIGHT OUTER JOIN)</li> </ul> </li> <li>b) SQL Functions <ul style="list-style-type: none"> <li>● Date and Time Functions (MONTH, DAYOFMONTH , YEAR, DATEDIFF, DATE_ADD and DATE_SUB, LAST_DAY)</li> </ul> </li> </ul>
4	<p><b>NoSQL – MongoDB</b></p> <ul style="list-style-type: none"> <li>a) Create &amp; Drop database in Mongoddb,</li> <li>b) Create collection and Drop collection,</li> <li>c) Insert, Find, and Update &amp; Delete documents.</li> <li>d) Find with Projection,</li> <li>e) Sorting, Indexing &amp; Create Backup</li> </ul>

5	<p><b>Project</b></p> <ul style="list-style-type: none"> <li>➤ Development of sample database using MySQL <ul style="list-style-type: none"> <li>i. Student Information System</li> <li>ii. Bank Transaction</li> <li>iii. Library Information System etc.</li> </ul> </li> <li>➤ How to take backup and restore</li> </ul>
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### Text Books & References

1. Mysql: The Complete Reference by VASWANI, McGraw Hill publication.1<sup>st</sup> edition, 2017
2. MongoDB: The Definitive Guide, Second Edition by [Kristina Chodorow](#), O'Reilly Media publication; Second edition (June 4, 2013)
3. [MySQL Explained: Your Step By Step Guide to Database Design](#) by [Mr. Andrew Comeau](#), CreateSpace Independent Publishing Platform; 2 edition (November 22, 2017).

### Learning Outcomes

On successful completion of the course, students will be able to

- Create and alter table structures using MySQL.
- Formulate queries to perform Insert, update and delete, select and rollback operations in a database.
- Build subqueries to extract rows from processed data.
- Create and manipulate collections in Mongodb and perform various operations.
- Design and implement a database for a given problem domain.

Course Code	Course Title
MCA CP 107	<b>Software Development Lab- I(C programming)</b>

Module No.	Title & Contents
1	<p><b>Data Types, Conditional Statements and Loops</b></p> <ul style="list-style-type: none"> <li>● Familiarization of data input/output and operators in C</li> <li>● Demonstration of Data type conversion (Hint: Usage of type casting).</li> <li>● Implementation of various Storage Types.</li> <li>● Demonstration of various loops.</li> <li>● Demonstration of nested if (Hint: Use logical operators).</li> <li>● Demonstration of switch... case structure..</li> </ul>

2	<p><b>Arrays , Recursion and pointers</b></p> <ul style="list-style-type: none"> <li>● Implementation of arrays.(One dimensional &amp; two dimensional)</li> <li>● Implementation of functions (Hint: Demonstrate call by value, call by schemes, passing of arrays).</li> <li>● Demonstration of various string operations (Hint: Usage of user defined functions)</li> <li>● Demonstration of recursion.</li> <li>● Demonstration of debugging pointer errors.</li> <li>● Demonstration of indirection operations using pointers</li> </ul>
3	<p><b>Structures and Unions</b></p> <ul style="list-style-type: none"> <li>● Implementation of structures (Hint: simple structure operations, array of structures).</li> <li>● Implementation of Union.</li> <li>● Implementation of pointers to structures and unions.</li> <li>● Demonstration of dynamic allocation of memory (Hint: malloc, calloc, realloc, free)..</li> </ul>
4	<p><b>Sorting , Searching and File Handling</b></p> <ul style="list-style-type: none"> <li>● Demonstration of sorting techniques (Hint: selection sort, bubble sort).</li> <li>● Demonstration of searching techniques (Hint: linear search, binary search).</li> <li>● Demonstration of bitwise operations.</li> <li>● Demonstration of macro processing.</li> <li>● Demonstration of various file operations. (Hint: Text file)</li> <li>● Implementation of character counting, line counting and word counting for a file.</li> </ul>
5	<p><b>Project</b></p> <p><b>Development of a Sample project</b></p>

### **Text Books & References**

1. Schaum's Outline of Programming With C, Byron Gottfried 4th Edition, Mcgraw-Hill
2. Programming In Ansi C, E. Balagurusamy, Eighth Edition,Mcgraw Hill Education.
3. The C Programming Language, Brian W. Kernighan And Dennis M. Ritchie 2nd Edition, Prentice Hall Of India (2015)

## Learning Outcomes

On successful completion of the course, students will be able to

- Select and model data using primitive and structured types.
  - Construct programs that demonstrate effective use of C features including arrays, structures & Pointers
  - Handle various sorting and searching techniques.
  - Create and manipulate Files using various file handling functions.
  - Design and implement an application for a given problem domain.

Course Code	Course Title
MCA CT 108	Employability Skill Training-Phase 1

Module No.	Title & Contents
1	<p><b>Motivation And Goal Setting</b> Motivation, Assertiveness, Career Exploration and Life Planning, Goal Setting, Time Management, Stress Management.</p> <p><b>Activity:</b> Must Read (<i>Institution option possible</i>)</p> <ol style="list-style-type: none"><li>1. Karmayogi: A Biography of E. Sreedharan by M. S. Ashokan</li><li>2. The 7 Habits of Highly Effective People – Stephen R. Covey</li><li>3. The Leader Who Had No Title - Robin Sharma</li></ol>
2	<p><b>Arithmetical And Verbal Reasoning Ability:</b> Problems on Numbers, Problems on Ages, Percentage, Ratio and Proportion, Time and Work, Time and Distance, Problems on Trains, Boats and Streams, Alligation or Mixture, Area, Average, Races and Games of Skill, Calendar, Clocks, Banker's Discount, Decimal Fractions, Heights and Distance, Odd Man Out and Series.</p> <p>Types of verbal reasoning, Analogy, Series Completion, Coding and Decoding, Blood Relation, Puzzle Tests, Direction Sense Test, Venn Diagrams, Logical Sequence of Words, Syllogism, Cause and Effect, Dice, Cube and Cuboid, Seating Arrangement.</p> <p><b>Activity:</b> Company wise sample Questions, Mock Test on Each Topic.</p>
3	<p><b>Data Interpretation &amp; Logical Reasoning</b> Tabulation, Bar Graphs, Pie Charts, Line Graphs.</p> <p><b>Activity:</b> Company wise sample Questions, Mock Test on Each Topic.</p>

4	<p><b>ENGLISH APTITUDE</b></p> <p>Fill in the blanks, Comprehension, Phrases and Sentences, Sequencing, Basic Grammar, Synonyms and Antonyms, technical Vocabulary, Common Errors.</p> <p>Activity: Practice Sets.</p>
5	<p><b>RESUME PREPARATION</b></p> <p>Resume Tips, Cover Letter, Sample Resume, Help for making a perfect Resume, Job Application Letters, E-mail messages.</p> <p>Activity: Individual Resume Evaluation</p>

**Note : 50% of the syllabus is intended to cover in online / activity mode**

### **Text Book & References**

1. Rizvi, Ashraf M., *Effective Technical Communication*, New Delhi, Tata McGraw Hill Education Private Limited.
2. Aggarwal, R. S., *Quantitative Aptitude for Competitive Examinations*, New Delhi, S. Chand and Company Pvt. Ltd.
3. Aggarwal, R. S., *Modern Approach to Verbal n Nonverbal Reasoning*, New Delhi, S. Chand and Company Pvt. Ltd.
4. <https://www.campusgate.co.in/>
5. <http://www.allindiaexams.in/reasoning/verbal-reasoning-questions-answers>
6. <https://www.sawaal.com/aptitude-reasoning-questions-and-answers.html>
7. <https://www.indiabix.com/logical-reasoning/questions-and-answers/>

### **Learning Outcomes**

By successfully completing this course, students will be able to

- Do self-assessment of strengths and weaknesses; identify what is lacking for a better personality and improve on it.
- Solve Quantitative, Verbal and Logical Reasoning and Comprehension problems in IT recruitment drives and other competitive exams.
- Organize and write an effective Cover Letter and Resume.



## Course Content -Semester 2

Course Code	Course Title	Continual Evaluation (Marks)	University Evaluation (Marks)	Total Marks
MCA CT 201	<a href="#">Optimization Techniques for Computer Applications</a>	25	75	100
MCA CT 202	<a href="#">Data structures and Algorithm Analysis</a>	25	75	100
MCA CT 203	<a href="#">Computer Networking with TCP/IP</a>	25	75	100
MCA CT 204	<a href="#">Data Science &amp; Big data Analysis</a>	25	75	100
MCA CP 205	<a href="#">Object oriented Lab(Java Lab)</a>	25	75	100
MCA CP 206	<a href="#">Software development lab-II (PHP)</a>	25	75	100
MCA CP 207	<a href="#">Data structures Lab using C</a>	25	75	100
<b>Total</b>				<b>700</b>

<b>Course Code</b>	<b>Course Title</b>
<b>MCA CT 201</b>	<b>Optimization Techniques for Computer Applications</b>

<b>Module No.</b>	<b>Title &amp; Contents</b>
<b>1</b>	<b>Introduction to OR</b> -The origin and development of OR, Nature and uses of OR, Modelling in OR <b>Introduction to Linear Programming</b> -Mathematical formulation of Linear Programming Problem, Graphical solution, special cases of graphical method
<b>2</b>	<b>Solving LPP-The simplex method</b> -slack and surplus variables, the simplex method ,special cases in simplex method <b>Artificial variable</b> -use of artificial variable, Big M method <b>Duality in LPP</b> , Dual-simplex method.
<b>3</b>	<b>Transportation Problem</b> -Introduction, The transportation Table, Loops in Transportation Table, Solutions of Transportation Problem, Finding an initial basic feasible solution, Degeneracy in T.P, MODI method, maximization in T.P <b>Assignment Problem</b> -Introduction, Hungarian method, maximization in Assignment Problem. The Travelling Salesman problem.
<b>4</b>	<b>Game Theory</b> - basic terms, Two-person zero sum game, saddle point, strategy, games with saddle point, maximin - minimax principle, games without saddle point-mixed strategy, arithmetic method , graphical method for $2 \times n$ and $m \times 2$ games, Dominance principle-solving $m \times n$ game <b>Queueing Theory</b> -queueing system, elements of queueing system, characteristics of queueing system, classification of queueing models, problems of model only.
<b>5</b>	<b>Networking analysis</b> - introduction, basic terms, rules of network construction, Critical Path Method(CPM), Programme Evaluation and Review Technique(PERT). <b>Simulation</b> -simulation concepts, basic ideas of Monte-Carlo simulation. <b>Sequencing</b> - models-basic terms, processing $n$ jobs through 2 machines, processing $n$ jobs through 3 machines.

### **Text Books & References**

1. Operations Research: Kanti Swarup, P.K Gupta and Man Mohan, 14 th edition
2. Operations Research: S Kalavathy, 2nd edition.
3. Operations Research: Hillier, Liberman
4. Operations Research: An Introduction: Taha H.A

### **Learning Outcomes**

At the end of this Course, the participants

- i) may get basic insights into Applications of Operations Research in Managerial Decision Making.
- ii) will get familiar with Scientific Tools and Models in OR for analysing the Business.
- iii) will be able to understand the basics of Decision Science.

Course Code	Course Title
MCA CT 202	Data structures and Algorithm Analysis

Module No.	Title & Contents
1	<p><b>Introduction:</b> Data Structures, Concepts of Data Structures, Implementation of Data Structures.</p> <p><b>Algorithms:</b> Definition, Performance analysis– Space complexity, Time complexity- Asymptotic notation, Practical Complexities, Performance Measurement.</p> <p><b>Arrays:</b> Ordered lists – representation of array, polynomial addition.</p> <p><b>Stacks and Queues:</b> Definition and concepts, Operations on stacks. Application of stacks- Evaluation of arithmetic expression, infix to postfix conversion, evaluation of postfix expressions. Queue:- representation of queue, Operations on queue, Circular queue, Deque, Priority queue, Application of queues.</p>
2	<p><b>Linked List:</b> Singly linked list- Insertion, deletion, traversing and searching. Linked stacks and queues, Doubly linked list- Insertion, deletion, Traverse and Search operations.</p> <p><b>Trees :</b> Basic terminology, binary trees, binary tree representation, algebraic expressions, binary tree traversals, Binary Search Tree –Insertion and Searching, Balanced Trees – AVL Tree.</p> <p><b>Graphs:</b> Terminology and representations, Traversals- BFS, DFS.</p>
3	<p><b>Searching and Sorting:</b> Searching – Linear search, Binary search, Comparison of both methods.</p> <p><b>Sorting</b> – Insertion, Selection, Heap, Radix, Comparison of various sorting methods.</p> <p><b>Hashing:</b> Hashing Concept, Hash functions, Collision Resolution</p>
4	<p><b>Divide and Conquer method</b> – General method, Finding the maximum and minimum, Analysis of Binary search, Quick sort and Merge sort.</p> <p><b>Greedy Method</b>– The general method, Knapsack Problem, Minimum cost spanning tree- Prim’s algorithm and Kruskal’s algorithm.</p>
5	<p><b>Dynamic programming Method-</b> General method, Multistage graphs, All pairs shortest paths.</p> <p><b>Backtracking:-</b>The general method, The 8-Queens problem. <b>Branch and Bound-</b> General Method, Least Cost search, control abstraction for LC search. Lower Bound Theory- Comparison Trees for Ordered searching, Sorting.</p>

### Text Books & References

1. Fundamentals of data structures – Ellis Horowitz and Sartaj Sahni (Galgotia , 1994)
2. Data Structures (Schaum’s Outline Series) by Lipschutz Seymour, Tata Mcgraw-hill
3. Classic data structures – D Samanta, 2 Edn. (PHI, 2009).
4. Fundamentals of computer algorithms- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajeshkharan

(Universities Press , 2008)

5. Data Structures – a pseudocode approach with C –Richard F Gilberg, Behrouz A Forouzan, Thomson Learning, 2 Edn., Cengage Learning C 2005
6. Data Structures Through C in Depth, S.K. Srivastava, Deepali Srivastava, (BPB Publications, 2003).

### Learning Outcomes

After completing this course the students will

- Have deep knowledge about the organization of data structures, Arrays, Linked Lists, Stacks, Queues, Trees and Graphs.
- be able to select the appropriate data structures for solving the given problem.
- be familiar with different sorting and searching methods and their features.
- Know the various algorithm design strategies and their applications. Thus will be able to choose the more suitable method for the given scenario.
- Know how to analyze the performance of devised algorithms using different analysis methods.

Course Code	Course Title
MCA CT 203	Computer Networking with TCP/IP

Module No.	Title & Contents
1	<b>Networking Models:</b> The OSI ref. Model, Layers in the OSI Model, TCP/IP protocol Suite, Comparison of the OSI and TCP/IP ref. Models, Addressing. <b>Physical Layer and functions. Data Link Layer:</b> Need for data link control, Framing, flow control - stop and wait, sliding window protocol, error detection - parity check, CRC, Error control - Stop and wait ARQ, Go back-N ARQ, Selective Repeat ARQ
2	<b>Wired LAN:</b> IEEE Standards-Frame Format-Addressing-Ethernet evolution. <b>Wireless LANS:</b> IEEE802.11, MAC Sub layer, Addressing Mechanism, Bluetooth-Architecture, Frame format, <b>Switched WANS:</b> X.25, ATM-ATM Architecture, ATM Layers. <b>Network Layer:</b> Introduction, Switching-Circuit switching, Packet switching, connection oriented and connectionless service, services provided by network layer.

3	<p><b>Network layer protocols-</b> Network Layer: <b>IP addressing</b>, IPv4 Addresses-Introduction, Classful addressing, Classless addressing. IPv6 Addresses-Introduction, Address space Allocation.</p> <p><b>Internet Protocol (IPv4)</b> Datagram format, Fragmentation, <b>IPv6-</b> Packet format. Transition from IPv4 to IPv6- Dual stack, Tunneling, Headertranslation.</p> <p><b>Address mapping protocols:</b> <b>ARP</b>-Address Mapping, ARP Protocol, <b>DHCP</b> - Introduction, Configuration.</p> <p><b>Error Reporting protocol:</b> ICMP-Introduction, Messages, <b>ICMPv6</b> Introduction, Error Messages, Information messages, Neighbour Discovery messages, Group Membership message.</p> <p><b>Routing Protocols-</b> Introduction, Intra understand the operation of various protocol and Inter domain routing, distance vector routing algorithm, <b>RIP</b> – message format, RIP Timers, Link state Routing, <b>OSPF</b>-Areas, Types of Links, OSPF packets, Link state update packet, Path vector routing, <b>BGP</b> – external and Internal BGP , Types of packets</p>
4	<p><b>Transport Layer:</b> Services, Transport - layer protocol. <b>UDP:</b> User Datagram, UDP Services, And use of UDP. <b>TCP:</b> TCP Services, TCP features, TCP Segment Header, TCP Connection management, Flow Control, Error Control, TCP Congestion control, TCP timers.</p>
5	<p><b>Application Layer: Domain Name System (DNS)</b> - Name space, DNS in the Internet, Resolution, DNS messages, Types of Records. <b>TELNET</b> -Time sharing Environment, Network virtual terminal, Embedding, options, <b>File Transfer Protocol(FTP)</b> -Connection, Communication, Command Processing, File transfer, Anonymous FTP,</p> <p><b>World Wide Web</b>-Architecture, Web documents, <b>HTTP--</b> HTTP transaction, Message formats, Persistent and Non persistent connection. <b>Electronic Mail:</b> - Architecture, User Agent, Message Transfer Agent (SMTP), Message Access Agent: POP, IMAP. Web-based mail.</p>

### Text Books & References

1. Data and Computer Communications – William Stallings, Eighth Edition.
2. Behrouz A. Forouzan - Data Communications and Networking- Fourth Edition- Tata McGraw Hill.
3. Behrouz A. Forouzan – TCP/IP Protocol Suite- Fourth Edition- Tata McGraw Hill.
4. Andrew S Tanenbaum- Computer Networks – Third Edition- PHI.

### Learning Outcomes

After completing this course the student must demonstrate the knowledge and ability to:

- Understand about basic computer network terminologies.

- Enumerate the layers of the OSI model and TCP/IP model and can explain the function(s) of each layer.
- Understand about subnetting and routing mechanisms.
- Identify the different protocols in TCP/IP and how they help in Internet communication.

Course Code	Course Title
MCA CT 204	Data Science & Big Data Analysis

Module No.	Title & Contents
1	<p><b>Introduction to Data Mining</b>            Introduction – Need for Data Mining – What Kinds of Data, Kinds of Patterns, Technologies, Applications and Issues - Data Objects and Attribute Types Data - Basic Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity - Data Pre-processing-An overview, Data Cleaning, Data Integration, Data Reduction- Overview, Attribute subset selection, Feature creation, Data Transformation and Discretization, OLTP vs OLAP.</p>
2	<p><b>Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods</b>            Basic Concepts-Market Basket Analysis, Frequent Itemsets, Closed Itemsets and Association Rules, Frequent Itemset Mining Methods - Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, A Pattern- Growth Approach for Mining Frequent Itemsets, Mining Frequent Itemsets Using the Vertical Data Format, Mining Closed and Max Patterns, Classification- Basic Concepts, General Approach to Classification, Cluster Analysis- Basic Concepts, Requirements for Cluster Analysis, Overview of Basic Clustering Methods</p>
3	<p><b>Introduction to Data Science</b>            Benefits and uses of data science and big data, Facets of data, The data science process, The data Science Process- Defining goals, Retrieving Data, Cleansing and Transforming data, Exploratory Data analysis, Build Models, Visualization.</p> <p><b>Understanding Big Data</b> - What is big data; why big data – convergence of key trends – unstructured data – Industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine advertising and big data – big data technologies.</p>
4	<p><b>Overview of Big Data, Techniques:</b> Structuring Big Data, Elements of Big Data, Big Data Analytics –Introducing Technologies for Handling Big Data : Hadoop, Cloud computing and Big data, In-memory computing - Understanding Hadoop Ecosystem: HDFS, MapReduce, Hbase, Understanding MapReduce fundamentals.</p>

5	<b>Storing Data in Databases and Data Warehouses:</b> RDBMS and Big Data, Non-Relational Database issues, Polyglot Persistence, Integrating Big Data with Traditional Data Warehouses - Processing Your Data with MapReduce: Developing Simple MapReduce Application - Understanding Hadoop YARN Architecture: Advantage, Architecture, Working , YARN Schedulers – Introducing Hive, Getting Started with Hive, Hive Services, Data Types in Hive, Built-In Functions in Hive.
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### Text Books and References

1. Jiawei Han, Micheline Kamber and jain Pei “Data Mining Concepts and Techniques” Third Edition, Elsevier, (c) 2012.
2. Davy Cielen, [Arno D.B. Meysman](#), [Mohamed Ali](#) “Introducing Data Science” 2<sup>nd</sup> edition, 2016.
3. DT Editorial Services,BIG DATA, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
8. Bill Schmarzo, “Big Data : Understanding How Data Powers Big Business”, Wiley, 2013
9. The Apache HBase HandBook Online : <http://hbase.apache.org/book.html>

### Learning Outcomes

At the end of this Course, the participants

- may get basic insights into Applications of Big Data concepts.
- will get familiar with Scientific Tools and Models in Data Science.
- will be able to understand the basics of Different tools used in Big Data Analysis.

Course Code	Course Title
<b>MCA CP 205</b>	<b>Object oriented Lab(Java Lab)</b>

Module No.	Title & Contents
1	<b>Basics of Java:</b> Programming concepts, Array implementation, Strings, Reading input from keyboard <b>Introduction to Object Oriented Programming concepts :</b> Classes, Methods, Constructors, access specifiers, Encapsulation, Polymorphism, Method & constructor overloading, Inheritance and its different types, super keyword, abstraction through abstract classes.

2	<p><b>Interfaces and Packages</b>- Built in and user defined packages, access protection in packages</p> <p><b>Exception handling</b>- basic concepts, types of exception, user defined exception</p> <p><b>Multithreading Programming</b> - Defining threads, Life cycle, creating single and multiple threads, Thread priorities, Synchronization</p> <p><b>File handling</b> - Built in methods, Reading , writing, copying and appending a file.</p>
3	<p><b>Applets</b> - Basics, Life cycle, applet methods, applet tag, passing parameters to applet, adding image file to applet,</p> <p><b>Working with Graphics, AWT Controls and Text</b> : Graphics programming, Color class, Font class, Font Metrics</p> <p><b>Swings</b> - Introduction, Hierarchy of classes, Controls with event handling</p>
4	<p><b>Layout Managers ,Menus</b> -Menubars, submenus, Dialog boxes, File Dialog <b>Database Connectivity</b> - JDBC overview, JDBC implementation &amp; its architecture, Establishing connectivity and working with connection interface, Working with statements, Creating and executing SQL statements, Working with Result Set</p>
5	<p><b>Networking</b>-Socket programming, TCP/IP, Datagram, Multicast</p> <p><b>Developing a GUI application</b></p>

### Text Books & References

1. Java The Complete Reference , Herbert Schildt 7th Edition. Tata McGraw-Hill Edition
2. Object Oriented Programming With Java, E.Balagurusamy 5th Edition, McGraw-Hill Education
3. Core Java VolumeII -Advanced Features, Cay S Horstmann and Gary Cornell,9th Edition,Pearson
4. Java Networking Programming, Elliotte Rusty Harold, 4<sup>th</sup> Edition,O'REILLY
5. Core Java For beginners, Rashmi Kanta Das, Revised Edition, Vikas Publishing House Pvt.Ltd
6. Programming with Java, Dr.T.V Suresh Kumar, Dr,B.Eswara Reddy, Raghavan P,First Edition Pearson
7. Introduction to Object Oriented Programming through Java, First Edition, ISRD Group, TataMcGraw Hill
8. A Text book on Object Oriented Design and Programming using Java, Divya B, Neena V.V and Akhil Paulose, First Edition
9. Online Resources : <https://www.oracle.com/in/java/technologies/javase-downloads.html>,  
<https://docs.oracle.com/javase/tutorial/>

### Learning Outcomes

On completion of the course,

- The student will be able to understand the applications of Object Oriented Programming concepts
- The students will illustrate the package concept and handling error mechanism in java
- The students will be able to understand GUI programming through database connectivity



Course Code	Course Title
MCA CP 206	Software development lab-II (PHP)

Module No.	Title & Contents
1	<b>PHP:</b> Introduction, Variables, echo / print , Data types , Strings , Constants , Operators , Control structures: Functions, Arrays, Super-global variables Implementing <b>.object-oriented programs using PHP:</b> Creating classes and accessing class members in different php pages, inheritance.
2	<b>PHP Forms:</b> Form handling, form validation, form required, Form Complete, Date and time, Cookies, Sessions. <b>File Handling in PHP, File Upload, Sending Email.</b>
3	<b>PHPMyAdmin :</b> db management in PHPMyadmin (create, drop, rename), table management (create, drop, rename, setting primary key, auto increment, default values, null),import data to the db (CSV/SQL), export data from db(CSV/SQL). <b>Connecting MySql from PHP:</b> mysqli_Connect, mysqli_query(create, insert, update, delete, limit data) ,mysqli_close,
4	<b>JavaScript-</b> Variables, Operators, Functions, Event Handling, Form Validation using JavaScript. <b>AJAX-</b> submitting a section of a page using AJAX
5	<b>Introduction to PHP frameworks-</b> Introduction to MVC architecture, Laravel, Basic features, Creating projects using Laravel, Mini Project. <b>Introduction to Semantic Webs:-</b> What is semantic web?, RAP: RDF API for PHP. <b>Introduction to Web Hosting:</b> Demonstration of how to host a php project on a server

### Text Books & References

1. Web Programming, Chris Bates, 3 rd Edition; Pub: John Wiley & Sons
2. The complete reference PHP, Holzner; 1<sup>st</sup> Edition McGraw Hill Education,
3. <https://github.com/PHPMailer/PHPMailer>
4. Official Laravel Documentation <https://laravel.com/docs/7.x>
5. <https://www.phptpoint.com/laravel-tutorial/>
6. <https://www.tutorialandexample.com/creating-first-laravel-project/>
7. <http://wifo5-03.informatik.uni-mannheim.de/bizer/rdfapi/tutorial/introductionToRAP.htm>
8. <https://o7services.com/blog/2019/12/21/upload-php-project-on-server-php>

### Learning Outcomes

On successful completion of the course, the students will be able to

- Define the basic fundamentals of PHP
- Understand the concept of Semantic web and web hosting.
- Differentiate between client-side validation and server-side validation
- Apply Oops concepts in PHP

- Create database and establish connection using PHP
- Develop web applications using advanced PHP frameworks.

Course Code	Course Title
MCA CP 207	Data structures Lab using C

Module No.	Title & Contents
1	<b>Arrays, Stacks and Queues:</b> <ul style="list-style-type: none"> <li>● Demonstrate polynomial addition.</li> <li>● Implementation of stack</li> <li>● Conversion of an infix expression to postfix expression</li> <li>● Evaluating a postfix expression</li> <li>● Implementation of linear queue.</li> <li>● Implementation of circular queue.</li> </ul>
2	<b>Linked List, Trees</b> <ul style="list-style-type: none"> <li>● Implementation of linked list and performing insertions and deletions at both ends and also in between</li> <li>● Implementation of linked stack</li> <li>● Implementation linked queue</li> <li>● Implementation of a doubly linked list</li> <li>● Creation of binary tree and binary search tree and performing the traversals</li> </ul>
3	<b>Searching and Sorting</b> <ul style="list-style-type: none"> <li>● Demonstrate linear search and binary search.</li> <li>● Demonstrate various sort algorithms – insertion sort, merge sort, quick sort and heap sort</li> </ul>

### Text Books & References

1. Fundamentals of data structures – Ellis Horowitz and Sartaj Sahni (Galgotia , 1994)
2. Data Structures (Schaum’s Outline Series) by Lipschutz Seymour, Tata Mcgraw-hill
3. Classic data structures – D Samanta, 2 Edn. (PHI, 2009).

### Learning Outcomes

On successful completion of the course, students will be able to

- Implement linear and non-linear data structures.
- Apply data structures such as stack, queue, linked lists and tree to solve various computing problems.
- Implement different searching and sorting techniques

## Course Content -Semester 3

Course Code	Course Title	Continual Evaluation (Marks)	University Evaluation (Marks)	Total Marks
MCA CT 301	<a href="#">Machine Learning Techniques</a>	25	75	100
MCA CT 302	<a href="#">Cyber Forensics</a>	25	75	100
MCA ET 303	Elective-1	25	75	100
MCA ET 304	Elective-2	25	75	100
MCA CT 305	<a href="#">Python Programming for Data Science</a>	25	75	100
MCA CP 306	<a href="#">Advance Operating System Lab using Linux</a>	25	75	100
MCA CP 307	<a href="#">Mini Project</a>	100	-	100
MCA CT 308	<a href="#">Employability Skill Training- Phase 2</a>	50	0	50
<b>Total</b>				<b>750</b>

Elective 1	
MCA 303_ET1	<a href="#">Artificial Intelligence</a>
MCA 303_ET2	<a href="#">Enterprise Resource Planning</a>
MCA 303_ET3	<a href="#">Computer Graphics And Multimedia</a>
MCA 303_ET4	<a href="#">Digital Image Processing</a>

Elective 2	
MCA 304_ET1	<a href="#">Cloud computing</a>
MCA 304_ET2	<a href="#">Cryptography and Network Security</a>
MCA 304_ET3	<a href="#">Business Management And Information</a>
MCA 304_ET4	<a href="#">Internet of Things ( IoT)</a>

Course Code	Course Title
MCA CT 301	Machine Learning Techniques

Module No.	Title & Contents
1	<b>Introduction to Machine Learning</b> Machine learning introduction, AI vs. Machine learning Vs. Deep learning, Types of machine learning-supervised learning, Unsupervised Learning, Reinforcement Learning, How machine learning works, Examples of machine learning applications
2	<b>Classification</b> Learning a Class from Examples, Vapnik-Chervonenkis (VC) Dimension, Bayes decision theory-Introduction, Classification, Discriminant functions, Parametric method- Maximum Likelihood estimation, Regression, Multivariate Data, Parameter Estimation, Decision trees- Univariate Trees, Pruning, Nearest Neighbor Classification, Support Vector Machines
3	<b>Feature Extraction</b> Feature Extraction and Selection: Entropy minimization, Feature selection through functions approximation, Binary feature selection. <b>Dimensionality Reduction:</b> Problems of dimensionality, Principal Component Analysis, Factor analysis, Linear Discriminant Analysis.
4	<b>Clustering</b> Introduction, Similarity measures, Clustering criteria, Distance functions, k-Means Clustering, Hierarchical clustering, DBSCAN <b>Combining Multiple Learners</b> Voting, Bagging, Boosting
5	<b>Artificial Neural Networks:</b> Introduction, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptrons, Feedforward operation and classification, Backpropagation Algorithm, Training Procedures, An Illustrative Example: Face Recognition using NN

### Text Books & References

1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition.
2. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification, Wiley, New York, 2001.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill International Edition
4. Chris Bishop, Pattern Recognition and Machine Learning
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference, and Prediction
6. V. S. Devi, M. N. Murty, "Pattern Recognition: An Introduction", Universities Press, Hyderabad, 2011.
7. Earl Gose, Steve Jost, "Pattern Recognition and Image Analysis", PHI Publishers, 1997.

## Learning Outcomes

On completion of the course, the student will be able to

- Recognize the characteristics of machine learning that make it useful to real-world problems.
- Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
- Understand how to use feature extraction and classification techniques.
- Understand how to use clustering techniques.
- Understand the concepts of NN and how to build a model using ANN.

Course Code	Course Title
MCA CT 302	Cyber Forensics

Module No.	Title & Contents
1	<p><b>Computer Forensics Fundamentals:</b> What is Computer Forensics, Use of Computer Forensics in Law Enforcement, Steps taken by Computer Forensics Specialists, Scientific method in Computer Forensic Analysis.</p> <p><b>Types of Computer Forensic Technology:</b> Types of Military Computer Forensic Technology, Types of Law enforcement, Types of Business Computer Forensic Technology</p> <p><b>Types of Computer Forensic Systems-</b>Basics of Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Biometric Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless network security systems.</p>
2	<p><b>Data Recovery:</b> Data recovery defined, Data backup and Recovery, The role of Backup in Data Recovery, The Data- Recovery Solution, Hiding and Recovering Hidden Data.</p> <p><b>Evidence Collection:</b> Why Collect evidence, Collection options, Types of Evidence, Rules of evidence, General procedure, Collection and Archiving, Methods of collection, Artifacts, Collection steps, Controlling contamination, Reconstructing the attack.</p>
3	<p><b>Conducting Digital Investigation-</b>Digital investigation process models, Scaffolding for digital investigations, Applying scientific method in Digital investigations-Formation and Evaluation of Hypotheses, Preparation, Survey, Preservation, Examination, Analysis, Reporting and Testimony.</p> <p><b>Computer Basics for Digital Investigators-</b>Basic Operation of Computers, Representation of Data, Storage Media and Data Hiding, File Systems and Location of Data, Dealing with Password Protection and Encryption, Log files, Registry, Internet traces.</p>

4	<p><b>Cyber Crimes</b>-What is Cyber Crime, Categories of Cyber Crime-Against Individual, Institution and States.</p> <p><b>Crime Types</b>-Basics of SQL Injections, Theft of FTP password, Cross-site scripting, Viruses, Worms, Logical bombs, E-mail bombing, DoS attack, Spamming, Web jacking, Identity theft and Credit card fraud, Data diddling, Salami attacks, Phishing, Cyber stalking, Spoofing, Pornography, Defamation, Computer vandalism, Cyber terrorism, Cyber warfare, Hacking</p> <p><b>Types of Hackers</b>-Black hat, White hat, Gray hat. Different types of Malwares</p>
5	<p><b>Cyber Laws</b>-Defining Cyber Law, Concept and scope of Jurisprudence, Basics of Cyber Space, Basics of IPC and CrPC, Indian Evidence Act.</p> <p><b>IT Act 2000</b>-Introduction to IT Act 2000, Amendment in IT Act, Different Offences under IT Act 2000-Sections:S.65,S.66, S.66A, S.66B, S.66C, S.66D, S.66 E, S.67, S.67A,S.67B,S.67C.</p>

### Text Books & References

1. Computer Forensics: Computer Crime Scene Investigation, John R. Vacca, 1st Edition, Charles River Media, 2005.
2. Digital Evidence and Computer Crime Forensic Science, Computers and the Internet, Eoghan Casey, 3rd edition, Elsevier, Academic Press, 2011.
3. Cyber Law & Crimes, 3rd Edition- Barkha & U.Rama Mohan, 3rd edition, Asia Law House.
4. Digital Evidence and Computer Crime, 3rd Edition, Eoghan Casey, Academic Press
5. [http://www.ijlt.in/pdf/Information-Technology-Act-\(as%20amended%20in%202008\).pdf](http://www.ijlt.in/pdf/Information-Technology-Act-(as%20amended%20in%202008).pdf)

### Learning Outcome

At the end of this Course, the students will be able to

- get a basic idea in Computer forensics
- Understand the importance of a systematic procedure for investigation of data found on various digital media
- Understand the various forms of computer crimes
- Understand the limitations imposed by cyber laws.

Course Code	Course Title
<b>MCA 303_ET1</b>	<b>Artificial Intelligence</b>

Module No.	Title & Contents
1	<p><b>AI Introduction and History:</b> Defining AI, Acting Humanly (Turing Test Approach), Thinking Humanly (Cognitive Modeling Approach), Thinking Rationally (laws of thought approach), Acting Rationally (Rational Agent Approach); Foundations of Artificial Intelligence. History of AI.</p> <p>AI Problems, Assumptions, Techniques, Level of Model, and Criteria for success. Problems, Problem spaces and Search - Problem Definition, Production systems, Problem characteristics, Production system characteristics.</p>

2	<p><b>Searching Problems:</b> Knowledge Organization and Management - Search and Control Strategies - Examples of search problem, Uniformed or Blind search, Informed search, Searching AND-OR graphs. Matching Techniques -Structures used for matching, Measures for Matching, Matching like patterns, Fuzzy matching algorithm</p>
3	<p><b>Knowledge Representation Schemes :</b> Formalized Symbolic Logics - Syntax and Semantics of Propositional and Predicate logic, Properties of WFFS, Inference rules, Resolution, Non- Deductive Inference Method. Inconsistencies and Uncertainties – Non-monotonic reasoning, Truth Maintenance system, Default reasoning and the closed world assumption. Structured Knowledge - Associative Networks</p>
4	<p><b>Knowledge Acquisition :</b> General Concepts in Knowledge Acquisition - Types of learning, Difficulty in Knowledge Acquisition, General learning model, Performance measures. Early work in Machine Learning – Perceptron, Genetic algorithms, Intelligent editors. Analogical and Explanation Based Learning – Analogical Reasoning and learning, Examples, Explanation based learning.</p>
5	<p><b>Natural Language Processing</b> - Overview of Linguistics, Grammars and Languages, Basic Parsing Techniques, Semantic Analysis and Representation structures, Natural Language generation, Natural language systems.</p> <p><b>Experts system Architectures :</b>Rule-based system, Non production system, Dealing with uncertainty</p> <p><b>Robotics:</b> Definitions, Connections between robotics and some related subjects: Artificial intelligence Flexible manufacturing systems, factory automation, computer-aided manufacturing</p>

### Text Books and References

1. Stuart Russel and Peter Norvig: Artificial Intelligence – A Modern Approach, 2nd Edition Pearson Education
2. Elaine Rich and Kevin Knight: Artificial Intelligence, Tata McGraw Hill 2nd Ed. N.P. padhy
3. Introduction to Artificial intelligence and expert systems by Dan W. Patterson, Prentice Hall India
4. Fundamentals of Robot Technology- An Introduction to Industrial Robots, Tele operators and Robot Vehicles D J Todd

### Learning Outcomes

Upon completion the students will be able to

- Explore the importance and relevance of AI in various fields & to understand about the basic theory of problem solving paradigm
- To be familiar with searching strategies applied in artificial intelligence.
- Enumerate the Knowledge representation using Rule based Algorithms and Reasoning
- Introduce the ongoing research and application of Artificial Intelligence in different fields like Natural language processing, Expert systems and robotics.

Course Code	Course Title
MCA 303_ET2	Enterprise Resource Planning

Module No.	Title & Contents
1	<b>Introduction to ERP:</b> Need for ERP, History of ERP, Justifying ERP Investment, Risks and Benefits of ERP, ERP-The Indian scenario, ERP Vendors
2	<b>ERP Business modules and Related technologies:</b> ERP Business modules- Financial, Manufacturing, HR Management, Plant Maintenance, Material Management, Quality Management, Marketing, Sales, Distribution and other services. Related Technologies- Business Intelligence and Business Analytics - E-commerce and E-Business, Business Process Reengineering (BPR), Data Warehousing (DW) and Data Mining (DM), Online Analytical Processing (OLAP), Geographical Information System (GIS).
3	<b>ERP Implementation:</b> Implementation challenges, ERP Implementation strategies, ERP Implementation life cycle, Implementation methodologies, ERP deployment methods.
4	<b>ERP Post Implementation:</b> Post-Implementation Activities, Employees and Employee resistance, Contracts with vendors-consultants-Employees, Trainings and Education, Data Migration, Project Management and Monitoring, Success and Failure factors of an ERP Implementation.
5	<b>ERP Present and Future:</b> ERP for Manufacturing Industries - ERP for Service Industries - Enterprise Application Integration (EAI) - ERP and Total Quality Management (TQM) - Future Directions and trends in ERP. ERP and security. Case Studies - Mysap Business solution implementation at ITC - Nestle Global Project - Oracle ERP implementation at Maruti Suzuki.

### Text Books & References

1. Rajesh Ray, Enterprise Resource Planning, McGraw Hill Education (India) Pvt Ltd.
2. Alexis Leon, ERP Demystified, McGraw Hill Education (India) Pvt Ltd., Third edition.
3. Alexis Leon, Enterprise Resource Planning, McGraw Hill Education (India) Pvt Ltd., Fourth edition.
4. ERP and Supply Chain Management by Christian N. Madu, Publisher: CHI

### Learning Outcomes

At the end of the course the student should be able to

- To build an understanding of the fundamental concepts of ERP systems, their architecture, and working of different modules in ERP.
- Students will also be able to understand different technologies used for building ERP systems and



different business modules associated with ERP system.

- To make the student aware about ERP implementation life cycle, methodologies and deployment methods.
- To make the student aware about the post implementation activities of an ERP project.
- Students will be able to understand the future directions, trends and possible security issues of ERP.

Course Code	Course Title
<b>MCA 303_ET3</b>	<b>Computer Graphics and Multimedia</b>

Module No.	Title & Contents
1	Introduction to graphics, Practical applications of computer graphics, Video Display Devices- Random Scan Display, Raster Scan Display , Three Dimensional Viewing Devices, Stereoscopic and Virtual-Reality Systems. Frame buffer. Color and Grey scale model.
2	Basic raster graphics algorithms-Points and lines: DDA and Bresenham’s line drawing algorithm, Midpoint Circle and DDA circle algorithm. Two dimensional transformations: translation, rotation, scaling, reflection and Shear. Matrix representations and homogeneous coordinates, composite transformations.
3	Window to viewport transformation , Filling- Boundary Fill , Flood Fill, Clipping operations- Point, Line- Cohen Sutherland Line Clipping Algorithm, Polygon, Text clippings.. Three dimensional geometric transformations- Translation, Scaling, Rotation. 3D viewing -Parallel, Perspective projections, Visible surface detection algorithms – Back Face Detection, Depth buffer method, A-buffer method. Surface Rendering-light sources, shading methods.
4	Multimedia-Introduction, Multimedia Presentation and Production, Characteristics, Hardware and Software requirements, Uses of Multimedia, Analog Representation, Digital Representation , Sampling Rate, Bit Depth, Quantization Error. Text-Types, font , Text Compression, File Formats, Image- Types, Color Models, Steps in image processing, File Formats.
5	Audio – Basic sound concept,MIDI ,Speech, Video and Animation- Basic Concepts,Computer –based Animation. Data Compression – JPEG, MPEG , DVI.

### **Text Books & References**

1. Hearn D,Baker ,(*Computer Graphics*), 2e,Prentice- Hall of India 2006.
2. Ranjan Parekh, “Principles of Multimedia”,2e, Tata McgrawHill,2014
3. Ralf Steinmetz and Klara Nahrstedt, “Multimedia Computing, Communications & applications”, Pearson ,7e, 2014
4. Foley, Vandam, Feiner, Huges,”Computer Graphics: Principles & Practice”, Second edition in C, Pearson Education, 2005
5. Ranjan Parekh, “Principles of Multimedia”, ,Tata McgrawHill,2006
6. D.P. Mukherjee, “Fundamentals of Computer Graphics and Multimedia”, PHI.

7. Hill Jr, "Computer Graphics using OpenGL", 2<sup>nd</sup> Edition, PHI
8. Nigel Chapman & Jenny Chapman, "Digital Multimedia", Wiley Publications.
9. Ralf Steinmetz and Klara Nahrstedt, "Multimedia Systems", Springer, 2004
10. Tay Vaughan, "Multimedia: Making it work", Seventh Edition, Tata McGraw-Hill Publishing company Ltd, 2007
11. Fred Halsall, "Multimedia Communication-Application Networks, Protocols and Standard", Addison-Wesley, 2001.

### Learning Outcomes

At the end of the course, the student should be able to

- understand and reproduce the core concepts of Computer Graphics and Multimedia
- develop the competency to understand the concepts related to rendering.
- apply mathematics and logic to visualize Computer programs for elementary graphic operations
- compile different Graphic and Multimedia formats
- summarize the different application of Computer Graphics and Multimedia

Course Code	Course Title
<b>MCA 303_ET4</b>	<b>Digital Image Processing</b>

Module No.	Title & Contents
1	<p><b>Introduction to Image Processing</b> –Nature of Image Processing, Image Processing and Related Fields, Digital Image Representation, Types of Images, Fundamental Steps in Image Processing, Image Processing Applications, Digital Imaging System,</p> <p><b>Physical Aspects of Image Acquisition</b> – Biological Aspects of Image Acquisition, Review of Digital Camera, Sampling and Quantization, Image Quality, Image Storage and File Formats</p>
2	<p><b>Digital Image Processing Operations</b> –Levels of Image Processing, Basic Relationship between pixels and Distance Metrics, Classification of Image Processing Operation – Arithmetic and Logic,</p> <p><b>Geometrical Operations</b> – Translate, Scaling, Zooming, Linear Interpolation, Shearing, Rotation, Reflection, Set Operation, Data Structure and Image Processing Application,</p> <p><b>Digital Image Transforms</b> – Need for Image Transforms, Types of Image Transforms, introduction to Fourier Transforms, Properties of Fourier Transforms</p>

3	<p><b>Image Enhancement and Restoration</b> – Image Quality and Need for Image Enhancement, Image Enhancement Point Operations – Linear and Non-Linear Functions – Intensity Slicing, Bit-plane Slicing, Histogram based techniques,</p> <p><b>Spatial Filtering Concept</b> – Smoothing and Sharpening Filters, Frequency Domain – Smoothing and Sharpening Filters,</p> <p><b>Image Degradation</b> (Restoration Model) –Categories of Image Degradation, <b>Color Image Processing</b>-, fundamental, Color Models – RGB, HSI,HLS, HSV <b>T V color Models</b>-, YUV Model, YIQ Model</p>
4	<p><b>Image Segmentation and Compression</b> – Introduction, Classification of Image Segmentation Algorithms,, Detection of Discontinuities – Point Detection, Edge Detection, Thresholding , Principle of Region Growing, Split and Merge, Pyramid Quadtree,</p> <p><b>Image Compression</b> – Fundamentals, Compression Models, Error free Compression – Variable Length Coding, Lossy Predictive Coding,</p> <p><b>Image Compression Standards</b> – JPEG, MPEG</p>
5	<p><b>Image Morphology</b> –introduction, Dilation and Erosion, Opening and Closing, Hit and Miss Transform, Basic Morphological Algorithms,</p> <p><b>Image feature</b> Representation and Description – Introduction, Boundary Representation, Boundary Description, Biometrics Case Studies</p>

**Text Books & References:**

1. Rafael.C.Gonzalez & Richard E.Woods, Digital Image Processing, Pearson Education
2. S. Sridhar, Digital Image Processing, Oxford Publisher.

**Learning Outcomes**

After the completion of this course, students will be familiar with:

- An overview of Digital Image Processing
- Acquire knowledge about large processing operation and transformations
- Understanding the concept of enhancing the quality of an image for analysis
- Adopts algorithmic approach to illustrate image processing

<b>Course Code</b>	<b>Course Title</b>
<b>MCA304_ET1</b>	<b>Cloud Computing</b>

<b>Module No.</b>	<b>Title &amp; Contents</b>
1	<p><b>Cloud Computing Foundation</b></p> <p>Introduction to Cloud Computing – History, importance and characteristics of Cloud computing. Move to Cloud Computing – migrating in to the cloud, seven step model. Types of Cloud – Public and Private Cloud, Cloud Infrastructure, Cloud Application Architecture. Working of Cloud Computing- Trends in Computing, Cloud Service Models, Cloud Deployment Models, Pros and Cons of Cloud Computing, Cloud Computing and Services: Pros and Cons</p>
2	<p><b>Cloud Computing Architecture and Virtualization</b></p> <p>Cloud life cycle model –Cloud Architecture. Cloud Modelling and Design – Virtualization- types of virtualization, benefits and pitfalls of virtualisation, virtualisation in Grid and Cloud, CPU virtualisation, network and storage virtualisation.</p>
3	<p><b>Data Storage and Cloud Computing services</b></p> <p>Data Storage - Data Storage Management, File Systems, Cloud Data Stores, Using Grids for Data Storage. Cloud Storage – Data Management for Cloud Storage, Data intensive Technologies for Cloud Computing- Cloud Storage from LANs to WANs - Distributed Data Storage, Applications Utilizing Cloud Storage. Cloud Services – software as a service, platform as a Service, infrastructure as a service, other cloud services.</p>
4	<p><b>Cloud Computing Security and tools</b></p> <p>Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services Cloud Computing Tools- Tools and Technologies for Cloud, Cloud Mashups, Apache Hadoop, Cloud Tools- VMWare, Eucalyptus, CloudSim, OpenNebula, Nimbus.</p>
5	<p><b>Cloud Applications and Future Cloud</b></p> <p>Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications. Future Cloud- Mobile cloud, Autonomic cloud engine, Multimedia Cloud, Energy aware Cloud computing, Jungle Computing.</p>

### **Text Books & References**

1. Cloud Computing – A Practical Approach for Learning and Implementation, A.Srinivasan and J.Suresh, Pearson India Publications, 2014
2. “Cloud Computing – insights into New-Era Infrastructure”, Kumar Saurabh, Wiley India,2011.
3. “Cloud Computing: Implementation, Management, and Security” John W.Rittinghouse and

- James F.Ransome, , CRC Press, 2010.
4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
  5. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
  6. “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Morgan Kaufmann Publishers, 2012.
  7. “Cloud Computing, A Practical Approach” Toby Velte, Anthony Velte, Robert Elsenpeter, TMH, 2009.

## Learning Outcomes

At the end of the course the student should be able to

- understand the fundamental concepts of Cloud Computing, cloud infrastructure and working of different service models and cloud deployment models.
- understand cloud architecture and Cloud virtualisation.
- aware about Data storage in cloud and about different cloud computing services.
- aware about the Security in cloud computing and different cloud computing tools.
- understand the cloud platforms used in industry, Clouds computing applications future directions and trends.

Course Code	Course Title
MCA304_ET2	Cryptography and Network Security

Module No.	Title & Contents
1	<b>Introduction:</b> OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Model for Network Security. <b>Classical Encryption Techniques-</b> Ceaser, Playfair, Hill and Railfence Ciphers. <b>Mathematical Tools for Cryptography</b> – Basic concepts of Groups, Rings, Fields, Modular Arithmetic, Euclidean Algorithm, Finite Fields of the form GF(p), Polynomial Arithmetic, Finite Fields of the form GF(2 <sup>n</sup> ). <b>Block Ciphers and Data Encryption Standard</b> - Feistel Cipher Structure, Data Encryption Standard, Strength of DES.
2	AES cipher, Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers and RC4, Pseudo Random Numbers, Pseudo Random Sequences, <b>Introduction to Number Theory:</b> Basic concepts of Prime Numbers, Fermat’s and Euler’s Theorems, Miller-Rabin Algorithm, Discrete Logarithm. Public-Key Cryptography and RSA algorithm, Security of RSA.
3	<b>Key Management</b> - Diffie-Hellman Key Exchange Algorithm, Elliptic Curve Cryptography, <b>Message Authentication and Hash Functions</b> - Authentication Requirements, Authentication Functions, Message Authentication Code, Simple Hash Functions. Hash and MAC Algorithms – SHA -512, HMAC, Digital Signatures, Digital Signature Schemes- RSA Digital Signature Schemes, ElGamal Digital Signature Scheme, Authentication Protocols

4	<p><b>Network Security Applications –Key Distribution and User Authentication</b>  - Principles- Remote User Authentication, Symmetric Key Distribution using Symmetric Encryption, Kerberos, Key Distribution using Asymmetric Encryption, X.509 Certificate, Public-Key Infrastructure.  <b>Network Access Control and Cloud Security</b>-Network Access Control, Extensible Authentication Protocol, IEEE802.1X Port-Based Network Access Control, Cloud Computing, Cloud security Risks and Counter measures, Data protection in the cloud.</p>
5	<p><b>Electronic Mail Security</b> – PGP, S/MIME. <b>IPSecurity</b> – Overview, Architecture, AH, ESP, Internet Key exchange. <b>Web and E- Commerce Security</b>- SSL/TLS, SET</p>

### Text Books & References

1. William Stallings, Cryptography and Network Security. Principles and Practice, 4th edition, Prentice Hall.
2. Behrouz A. Forouzan, Cryptography & Network Security, Tata McGraw Hill.
3. William Stallings, Network Security Essentials: Applications and Standards, Sixth Edition, Pearson India Education Services Pvt.Ltd.

### Learning Outcomes

- Understand the types of cryptographic algorithms and methods used to implement security of data at various levels and on the network.
- Students are able to understand the mathematical tools behind each algorithm.
- Understand secure key exchange protocols.
- Be able to digitally sign emails and files.

Course Code	Course Title
MCA304_ET3	<b>Business Management And Information System</b>

Module No.	Title & Contents
1	<p><b>Management And Decision Making:</b>  Basic Managerial Concepts, Levels Of Management, Managerial Skills, Concept Of Management Principles, Managerial Functions. Planning-meaning, Nature, Structure, Steps, Effective Planning. Organizing-meaning, Process, Structure, Types Of Organization. Staffing-meaning, Nature, Staffing Process, Recruitment &amp; Selection. Motivation-significance, Motivational Theory -maslow's Need Hierarchy. Leadership, Communication -formal &amp; Informal. Barriers, Effective Communication, Controlling-steps, Objectives, Features Of A Good Control System.</p>

2	<p><b>Mis And Digital Firm</b>  Mis-definition, Physical And Conceptual View Of Mis, Role Of Mis, Management Effectiveness And Mis, Mis For A Digital Firm, E-business Enterprise, Organisation Of Business In A Digital Firm, E-business, E-commerce, E- communication, E-collaboration, It Impact On Society, Impact Of It On Privacy, Ethics, Intellectual Property, Copyright, Patents.</p> <p><b>Decision Making Process In Business Organisation:</b> Decision Making Process, Types Of Decisions, Selection Of Decision Alternatives, Four Ways Of Decision Analysis.</p>
3	<p>Information Concepts-characteristics, Types, Methods For Collection Of Data And Information. Knowledge And Kms, Bi For Mis, Tools And Techniques Of Bi, Generation Process Of Bi, Applications Of Is And It To Management Functions Of The Industry.</p> <p><b>Applications Of Information Systems In Manufacturing And Service Sector-</b> Personnel Management, Fm, Product Management, Raw Material Management, Marketing Management, Service-concept, Process Cycle, Sms, Mis Applications In Service Industry.</p>
4	<p><b>Dss, Ai Applications</b>  Dss-concept, Types, Gdss, Ai System, Expert System, Neural Networks, Applications Of Ai-interpretation Systems, Prediction Systems, Diagnostic Systems, Design Systems, Monitoring And Control System, Repair System, Kbes, Decision Tree For Decision Analysis, Flow Chart Of Expert System Of Online Support.</p> <p><b>Systems For Management Of Global Enterprise:</b> Ems, Erp, Erp Model And Modules, Characteristics, Erp Implementation, Scm, Crm, Features Of Global Enterprise.</p>
5	<p><b>Software Project Management</b> Introduction, Difference Between Software Projects And Other Types Of Projects, Software Project Management Activities, Steps In Project Planning, Formal Planning And Control Tools-gantt Chart, Pert Chart, Managing People In Software Environments, Software Quality-product And Process Quality Management-iso, Sei Cmm, Cmmi, Six Sigma.<b>Prince2</b> Project Management Method-introduction, Components, Planning Techniques, Major Prince2 Processes.Pm Tools.</p>

### Text Books & References

1. Principles of management, R.N. Gupta, S. Chand & Company Ltd.
2. Principles of management, L.M. Prasad, S. Chand publication
3. Business management, R.K. Sharma & Sasi K. Gupta.
4. Management Information Systems-Waman S. Jawadekar, 5<sup>th</sup> edition, McGraw Hill Publication
5. Management Information Systems- O'Brien, Marakas and Behl, 10<sup>th</sup> edition, Tata McGraw Hill Publication.
6. Management Information Systems Laudon & Laudon, 13<sup>th</sup> Edition, Pearson Education.
7. Software Project management , Bob Hughes, Mike Cotterell, 5<sup>th</sup> edition, McGraw Hill

Publication

### Learning Outcomes

- The participants will get basic insights into the Flow of Information in an Organisation
- The participants will understand how data and information is used in the process of managerial decision making
- The participants will be familiarized with the common information systems used in local and global business organisations.
- The participants will be able to understand the management of software projects and methods used for that.

Course Code	Course Title
MCA304_ET4	Internet of Things (IoT)

Module No.	Title & Contents
1	<b>Understanding the Internet of Things (IoT):</b> Defining IoT, Characteristics of IoT, Physical design of IoT-Things in IoT, IoT protocols, Logical design of IoT, Functional blocks of IoT, IoT communication models and APIs, IoT enabling technologies, IoT levels & Deployment templates.
2	Domain specific IoTs, Networking IoT and Communication protocols – Link Layer, Network Layer, Transport layer, Application Layer, Wireless Sensor Networks and Machine to Machine communication- Differences and similarities between M2M & IoT, Software defined networking, Network function virtualization.
3	M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol –Modbus– Zigbee Architecture – Network layer –LowPAN - CoAP – Security.
4	Building IoT - RASPBERRY Pi- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device, Sensor deployment & Node discovery, Data aggregation & dissemination
5	Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Implementation of IoT.

### Text Books and References

1. Vijay Madiseti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenequs Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
4. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014



5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.
6. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons, 2013.
7. Cuno Pfister, “Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud”, Maker Media, 2011.
8. Pethuru Raj and Anupama C. Raman , “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, (CRC Press).

### Learning Outcomes

At the end of the course, the students will be able to

- Understand the definition and significance of the Internet of Things
- Understand the various application areas of IoT, Study the protocol stack of IoT communication, get an understanding of differences between Machine to Machine and IoT. Get basics of Software Defined Networking (SDN) and Network Function Virtualization (NFV).
- Illustrate the protocols used by M2M, WSN, SCADA and RFID. Understand architecture and protocol stack of Zigbee, BACNet, LowPAN, CoAP
- Learn to build a simple IoT system using Raspberry Pi. Basic coding of Python to implement IoT system, understand the concepts of IoT devices, sensor deployment, node discovery. Enumerate the data aggregation & dissemination method
- Acquire basic knowledge of Arduino programming to build an IoT system, learn how to interface sensors & actuators with Arduino software.

Course Code	Course Title
MCA CT 305	Python Programming for Data Science

Module No.	Title & Contents
1	<b>Data Types, Data and Control Structures , Operators</b> Introduction to python, Python variables and assignments, <b>Data types in python-</b> Numbers, Strings, List and List processing, Tuple, Set, Dictionary. <b>Operators. Flow Control:</b> – Decision making statements and loops, Functions: - Function and Function arguments, Anonymous functions, Recursive functions, User defined functions.
2	<b>Classes, File Handling and Database Programming</b> <b>Class:</b> – Class, Constructor and methods. <b>File handling in python:-</b> Opening a file, Closing a file, Writing to a file, Reading from a file. <b>Modules:-</b> Modules and importing modules. <b>Exception Handling:</b> -Built -in-Exceptions and user defined exceptions. <b>Database programming:-</b> python-SQLite connectivity

3	<p><b>Web programming with Django</b>  <b>Python web application framework - Django:-</b> Introducing models, Views, Templates, urls, Custom user models, Permissions, Static and dynamic web pages, Deployment.</p>
4	<p><b>Handling data in Data Science</b>  Introduction to Data Science. <b>Exploring data analysis with Pandas</b> :-Accessing and preparing data - Reading a file ,indexing, selecting a subset. <b>Data preprocessing with python:-</b>Dropping columns in a dataframe, Changing the index of a dataframe, Tidying up fields in the data, Cleaning columns and data, Renaming columns and skipping rows. <b>Numerical analysis using NumPy:-</b> Handling arrays and analysing data.</p>
5	<p><b>Data Visualization and Machine Learning algorithms</b>  <b>Data visualization with Matplotlib</b> :-Understanding the plot, Creating 2-D plots, Multiple plots, Types of plots. <b>Linear Regression:-</b>Simple and Multiple regression, <b>Machine Learning algorithm implementation with Scikit-learn:</b> - Implementation of at least one classification and clustering algorithms. <b>Introduction to Text Analytics.</b></p>

**Implementation** of 4<sup>th</sup> and 5<sup>th</sup> module - Jupyter Notebook. Familiarization of Google Colab for data science is desirable

### Text Books & References

1. An Introduction to Python by Guido Van Rossum, Fred L.Drake, Network Theory Limited.
2. Programming and Problem Solving with Python, Ashok Namdev Kamthane & Amit Ashok Kamthane, McGrawHill Education (India) Private Limited
3. Django for Beginners: Build websites with Python and Django Paperback – March 7, 2018 by William S. Vincent
4. Python Data Science Handbook - Essential Tools for Working with Data , Jake VanderPlas,O'Reilly
5. Exploring Python, Timothy A Budd, Tata McGraw Hill Education Private Limited, Edition 2011
6. Think Python,Allen B Downey,O'Reilly
7. Programming in Python 3 by Mark Summerfield, Pearson Education
8. Python Applications Programming Third Edition, Wesley J.Chun, Pearson India Education Services Pvt.Ltd
9. Mastering Python for Data Science by Samir Madhavan, PACKT Publishing
10. Python for Data Analysis Paperback – 26 October 2012 by Wes Mckinney , O'REILLY
11. Data Science from Scratch- JoelGrus,O'Reily Publication

### Online references:

1. <http://www.tutorialspoint.com/python/>, <http://docs.python.org/tutorial/>,
2. <http://zetcode.com/tutorials/pythontutorial/>,<http://www.sthurlow.com/python/>,
3. <http://www.djangoproject.com/>,<http://www.djangobook.com/> ,<https://realpython.com/>

### Learning Outcomes

At the end of this Course, the students

- will get the programming skills required to develop python application programs.
- will be able to develop web applications using the django framework.

- will learn Data handling using python.

Course Code	Course Title
MCA CP 306	Advance Operating System Lab using Linux

Module No.	Title & Contents
1	<p><b>Introduction to Linux Operating System and its Installation:</b> Work within a command line environment.</p> <p><b>General purpose utilities-</b>cal, date, echo, printf, passwd, who, whoami, man, info, clear, tty, pwd, cd, uname.</p> <p><b>Linux file system structure-</b>Absolute path and relative path, types of users, su and sudo commands, types of shells, types of files, local and global variables, env command, environment variables-HOME, PATH, PS1, PS2, LOGNAME, SHLVL, SHELL.</p> <p><b>Basic Administration commands:Memory Usage commands</b> – top, free, vmstat, pstree, dmidecode</p> <p><b>Disk related commands:</b> df, du, ulimit</p>
2	<p><b>Handling files-</b>touch, cat, cp, rm, mv, ls, mkdir, rmdir, find Wild Characters</p> <p><b>File comparison commands:</b>cmp, comm, diff.</p> <p><b>I/O redirection:</b>Pipe &amp; Filters- head, tail, more, less, grep, sort, wc, nl, pg, tr, tee, cut, paste, sort, sed, awk.</p> <p><b>Compressing and archiving files:</b>tar, gzip, gunzip</p> <p><b>Basic File Attributes:</b>chmod, chown, umask</p>
3	<p><b>Process management commands:</b> init process, background and foreground processes, ps, nohup, nice, kill, time, fork.</p> <p><b>Scheduling commands:</b> Cron daemon, at, batch, crontab</p>
	<p><b>Communication:</b> utilities -mesg ,who-T ,talk, write ,wall ,finger, chfn, ping, traceroute, ftp, mail .</p> <p><b>Linux login:</b> using Telnet, ssh.</p>

4	<p><b>Essential System Administration</b>-Administrator's privileges, adding and removing users, user management, startup and shutdown commands.  Configuration and system log files.  <b>Managing file system</b> – mkfs, fsck  mounting a file system  Bash startup files  Installing packages  Printer administration, Files and printer sharing using samba,  <b>Introduction to Linux Servers</b>- Apache ,squid  <b>Editors</b>-vi, Emacs X  window system</p>
5	<p><b>Shell Programming</b>-Shell variables, shell keywords, positional parameters, passing command line arguments, shift command. Command substitution, expr, bc, eval.  <b>Conditional Statements</b>-test command, if statement, case structure <b>Loop control structure</b>:while, until and for loops, seq, break, continue Shell meta characters, functions, arrays, Advanced shell scripts.</p>

### Textbooks & References

1. Sumitabha Das, "UNIX: Concepts and Applications" Tata McGraw Hill (Fourth Edition)
2. Yashwant Kanetkar, "UNIX Shell Programming" BPB Publications (First Edition)
3. Operating System - Linux, NIIT Press, PHI Publisher, 2006 Edition
4. .Christopher negus –Red hat Linux Bible,Wiley Dreamtech India 2005 edition

### Learning Outcomes

Upon completion of this course, the student will be able to:

- Run various Linux commands on a standard LINUX Operating system (Ubuntu flavor of the Linux Operating system is preferred)
- Manage Files and directories in Linux operating system
- familiarize process creation, scheduling task and work with networking utilities
- Master the basics of Linux administration
- Acquire the shell script writing skills.

Course Code	Course Title
MCA CP 307	Mini Project

Phases	Description
1	<b>Formation of Project Team:</b> Students should form a team to fulfill the project with a maximum of two members. However, an individual student can also undertake the project on his/her own. A faculty will be assigned for each team as a guide for assisting monitoring the project work
2	<b>Identification of Topic:</b> The team should identify a topic of social relevance in discussion with the guide and should submit an abstract of the project for approval to the project coordinators.
3	<b>First interim Presentation:</b> Once the title is approved students should work on it and present the system design documents Table design, DFD/UML during the first interim.
4	<b>Demonstration of coding phase 1</b>
5	<b>Demonstration &amp; Testing of coding phase 2</b>
6	<b>Submission of the draft report</b>
7	<b>Submission of the final report:</b> Students should submit the final report incorporating all the corrections suggested by the guide in the prescribed format. One hardbound copy can be kept with the student. The finalized softcopy of the project can be kept in the department/library.

### Textbooks & References

1. Software Engineering A Practitioner's Approach, Roger S Pressman, McGraw-Hill International Edition, Sixth Edition.
2. Applying UML and Patterns, Craig Larman, Pearson, third edition
3. Object-Oriented Modeling and Design with UML, Michael Blaha, James Rumbaugh, Person, second edition.
4. Ian Sommerville, Software Engineering VII th Edition, Pearson Education

### Learning Outcome

After successful completion of the course, students will be able to

- practice acquired knowledge within the chosen area of technology for project development.
- identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
- reproduce, improve and refine technical aspects for engineering projects

- work as an individual/ team in the development of technical projects
- communicate and report effectively project related activities and findings

Course Code	Course Title
MCA CT 308	Employability Skill Training-Phase 2

Module No.	Title & Contents
1	<p align="center"><b>Interpersonal Communication And Leadership</b></p> <p>Interpersonal Communication, Concept of Leadership, Types, Six Styles of Leadership, Qualities of Leadership, Functioning of Leadership - Goal Setting, Rising to Your Potential, Coordinating, Decision making, Interacting, Negotiating, Time Management, Change Management and Mentoring. Accountability, Public Speaking &amp; Presentation Skills.</p> <p><b>Activity: Team Game</b></p>
2	<p><b>Effective Technical Communication</b></p> <p><b>Fundamentals:</b> Importance and Need, Technical Communication Skills, Organisation in Technical Communication, Styles in Technical Communication, <b>Speaking Strategies:</b> Strategies for Good Conversation, Improving Listening Comprehension, Improving Fluency and Self-expression – Articulation,</p>
	<p>Pronunciation, Voice Quality, Accent and Intonation. Body Language – Eye Contact, Facial Expression, Gestures, Posture and Body Movements.</p> <p><b>Activity: Exercises on Listening and Speaking</b></p>
3	<p align="center"><b>Group Discussion</b></p> <p>Nature, Characteristics of Successful GD, Group Discussion Strategies, Techniques for Individual Contribution, Group Interaction Strategies, Practice Case Studies.</p> <p><b>Activity: Group wise GD Training</b></p>
4	<p><b>Individual And Group Interview</b></p> <p>Characteristics of Interviews, Pre-Interview Preparation Techniques, Projecting a Positive Image, Answering Strategies. Types of Questions, Frequently Asked HR Questions</p> <p><b>Activity: Sample interview</b></p> <p><b>Topics Covering On Technical:</b> C Language, Operating Systems, Data Structures, C++, Microprocessors, DBMS, Networking, Java Basics, Core Java, Advanced Java, PHP, Python, SQL and other relevant topics.</p>
5	<p><b>Activity: Mock Interview</b></p> <p>Individual &amp; Group Interview Sessions</p>

*50 % of the syllabus is meant for online/ activity mode*

### Textbooks and Reference

1. Bharathi, T., Hariprasad, M. ed., Prakasam, V., *Personality Development and Communicative English*, Hyderabad, Neelkamal Publications Pvt. Ltd.,.
2. Rizvi, Ashraf M., *Effective Technical Communication*, New Delhi, Tata McGraw Hill Education Private Limited.
3. <https://www.indiabix.com/interview/>
4. <https://www.campusgate.co.in/>
5. <https://www.sawaal.com/technical-questions-and-answers.html>

### Learning Outcomes

- Understand all aspects of communication and its effect on giving and receiving information.
- Identify his/her analytical and lateral thinking, constructive argument capabilities, clarity of thoughts and capability to hold a discussion with a group.
- Understand the purpose of professional interviews.
- Articulate the importance of self-preparation.
- Students are able to practice their interviewing skills in an environment similar to an actual interview.

## Course Content -Semester 4

Course Code	Course Title	Continual Evaluation (Marks)	University Evaluation (Marks)	Total Marks
MCACS 401	<a href="#">Seminar</a>	50	-	50
MCA CP 402	<a href="#">Main Project</a>	150	150	300
MCA CV 403	<a href="#">Course Viva</a>	-	100	100
<b>Total</b>				<b>450</b>

Course Code	Course Title
<b>MCA CS 401</b>	<b>Seminar</b>

- To develop the ability to seek clarification and defend the ideas of other research works effectively.
- To acquire skills to raise queries and to answer the queries in an effective manner

Phases	Description
1	<b>Identification of Topic:</b> Each student will be assigned with an internal guide . Students should identify a topic of Current / Future trends related to Information Technology/ Computer Science/ Computer Applications in discussion with the guide.
2	<b>Submission of Abstract :</b> An abstract of the topic has to be submitted to the seminar coordinators for approval.
4	<b>Discussion with Guide :</b> Students should interact with the internal guide once in a week through online or offline mode and the guide should assess the progress of work and should keep a record of the same
3	<p><b>Submission of Report :</b> Students should prepare a seminar report as per the following guidelines</p> <ul style="list-style-type: none"> <li>● No of pages: Not less than 10 ( contents only )</li> <li>● Size A4, One-sided</li> <li>● Font: Times New Roman</li> <li>● Text Size 12; Title Size 14 Underlined; Line spacing: 1.5 Full Justified</li> <li>● Spiral Binding with uniformity in bind cover.</li> </ul>
4	<b>Submission of Presentation Slides :</b> The students should get the presentation slides corrected by the internal guide and provide a hard copy with the sign of the internal guide before the presentation
5	<b>Presentation &amp; Evaluation :</b> Every student is expected to present the seminar ((30-45 mins including Q/A and discussion sessions) before the evaluation committee consisting of two/three faculty members from the MCA Department duly appointed by the HoD.

### Learning Outcome

After successful completion of the course, students will be able to

- Provide insight knowledge in the selected topic of the seminar.
- Helps to improve analytical skills.
- To develop interest towards research in the field of Computer Science and its application areas.
- Improves communication and presentation skills
- Helps to nurture critical thinking skills.
- Improves comprehensive writing skills



<b>Course Code</b>	<b>Course Title</b>
<b>MCA CP 402</b>	<b>Main Project</b>

<b>Phases</b>	<b>Description</b>
1	<b>Identification of Topic:</b> A faculty will be assigned for each student as a guide for assisting and monitoring the project work . The student should identify a topic of social relevance in discussion with the guide . As the majority of the students are expected to work out a real-life project in certain industry/research and development laboratories/educational institutions/software companies, it is suggested to select the project with direct relevance to day-today activities of the student. However, it is not mandatory for a student to work on a real-life project. The project being developed can be hardware, Software application, IoT, and Mobile application.
2	<b>Submission of Synopsis:</b> The synopsis of the project consisting of Project Title/framework/frontend/backend along with the abstract should be submitted to the internal guide and one copy to the Project coordinator for approval. A student cannot start the project without getting the approval of the Project guide
3	<b>First interim (REQUIREMENT ANALYSIS PHASE) :</b> The students should submit a report to the internal guide and project coordinator with following contents on the date specified by the college <ul style="list-style-type: none"> <li>- Introduction about the project</li> <li>- Detailed description regarding the requirement analysis phase</li> <li>- Difficulties faced in this phase</li> </ul>
4	<b>Second Interim – DESIGN PHASE :</b> The second interim can be scheduled 25 days after the first interim. Students should report in the college and should give a presentation of his work before the evaluation committee. The Powerpoint presentation should contain the following <ul style="list-style-type: none"> <li>- Project introduction.</li> <li>- DFD, Database Design, Form Design.</li> <li>- Difficulties faced.</li> </ul>
5	<b>Third Interim:</b> The third interim can be conducted 15 days after the second interim. The students should send/submit their current status report of their project to their respective Internal guides and project coordinator through email / or report directly to the college. The status report should contain the updated and corrected Database design, DFD, and other modifications suggested to the students during the 2 <sup>nd</sup> Interim Report.

6	<p><b>Fourth Interim –(TESTING AND IMPLEMENTATION PHASE):</b> The fourth interim can be conducted 25 days after the third interim report. Students are expected to present the following contents to the evaluation committee</p> <ul style="list-style-type: none"> <li>➤ Introduction of the project</li> <li>➤ The description of coding</li> <li>➤ Testing and implementation of the project.</li> <li>➤ Submit a copy of the Algorithm. (optional)</li> <li>➤ Specify a report on the minimum requirements needed to run the software.</li> <li>➤ Difficulties faced in this phase.</li> </ul>
7	<p><b>Submission of Final Draft of Record:</b> Students have to submit a copy of the project report in the prescribed format, to their Internal Guides for correction within 15 days after the fourth interim. Project Report should compulsorily include software development</p>
8	<p><b>Final Project presentation:</b> Students have to present their complete work ( PowerPoint Presentation / Live project execution ) before the internal evaluation team consisting of the project coordinators and the internal guide. The final project presentation should include a detailed explanation from chapter 1 to chapter 11.</p> <p>Students have to submit 2 hard bound copies of final project reports (Personal Copy &amp; Office Copy) along with softcopy.</p>
9	<p><b>External Evaluation:</b> Students have to explain their project and submit the final record, complete in all respect before the external evaluators appointed by the university.</p>

### Textbooks & References

1. Software Engineering A Practitioner's Approach, Roger S Pressman, McGraw-Hill International Edition, Sixth Edition.
2. Applying UML and Patterns, Craig Larman, Pearson, third edition
3. Object-Oriented Modeling and Design with UML, Michael Blaha, James Rumbaugh, Person, second edition.
4. Ian Sommerville, Software Engineering VII th Edition, Pearson Education

### Learning Outcome

After successful completion of the project work, students will be able to:

- Apply Systems Development Life Cycle(SDLC) models to identify, analyse and evaluate system requirements.
- Design the system by constructing various design diagrams consisting of UML's, DFD's,

flow charts, state diagrams etc..

- Acquire knowledge on the implementation of various software tools in the design process.
- Develop Code to provide a solution to the problem.
- Prepare the documentation and reports of the projects.
- Propose future scope and further enhancement of the system.
- Develop presentation and communication skills.

<b>Course Code</b>	<b>Course Title</b>
<b>MCA CV 403</b>	<b>Course Viva</b>

<b>Phases</b>	<b>Description</b>
1	Viva Voce: The evaluators duly appointed by the university will have to do a comprehensive evaluation of what the student learned through the entire MCA Programme . Students should be evaluated through all core subjects of the MCA programme and marks will be awarded on the basis of oral answers given by the student.
2	Evaluation of Online course certification: Students have to submit the certificate of the online course he/she has completed by the 3rd semester of MCA . 25 % of the total marks is set apart for this.

### **Learning Outcome**

After the course viva, students will be able to

- To know the importance of each subject and its contribution towards knowledge.
- Evaluate and justify their level of knowledge after the MCA Programme.
- To throw light on the students regarding their areas of interest and the areas to be improved.