



Department of Computer Applications

## MCA PROGRAMME

(Last Updated: July 2019)

## **PART I : COURSE STRUCTURE**

**FIRST YEAR**  
**FIRST SEMESTER**

<b>A. Theory</b>							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP1101	Introduction to Programming	3	1	0	4	4
2	MCAP1102	Mathematical Foundations	3	1	0	4	4
3	MCAP1103	Numerical Analysis	3	1	0	4	4
4	HMTS1101	Accounting and Management Control	3	0	0	3	3
5	HMTS1102	Oral and Written Communications	3	0	0	3	3
<b>Total Theory</b>						<b>18</b>	<b>18</b>
<b>B. Laboratory</b>							
6	MCAP1111	Programming Lab	0	0	4	4	3
7	HMTS1112	Communications Lab	0	0	4	4	3
<b>Total Practical</b>						<b>8</b>	<b>6</b>
<b>Total of Semester</b>						<b>26</b>	<b>24</b>

**SECOND SEMESTER**

<b>A. Theory</b>							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP1201	Computer Organization and Architecture	3	1	0	4	4
2	MCAP1202	Data Structures	3	1	0	4	4
3	MCAP1203	Database Management Systems I	3	1	0	4	4
4	MCAP1204	Information System Analysis Design and Implementation	3	1	0	4	4
5	MCAP1205	Probability and Statistical Computing	3	1	0	4	4
<b>Total Theory</b>						<b>20</b>	<b>20</b>
<b>B. Laboratory</b>							
6	MCAP1211	Digital Logic and Computer Architecture Lab	0	0	4	4	3
7	MCAP1212	Data Structures Lab	0	0	4	4	3
8	MCAP1213	DBMS I Lab	0	0	4	4	3
<b>Total Practical</b>						<b>12</b>	<b>9</b>
<b>Total of Semester</b>						<b>32</b>	<b>29</b>

**SECOND YEAR**  
**THIRD SEMESTER**

<b>A. Theory</b>							
<b>Sl.</b>	<b>Code</b>	<b>Subject</b>	<b>Contacts Periods/Week</b>				<b>Credit Points</b>
			<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	
1	MCAP2101	Object Oriented Programming	3	1	0	4	4
2	MCAP2102	Database Management Systems II	3	1	0	4	4
3	MCAP2103	Operating Systems	3	1	0	4	4
4	MCAP2104	Design and Analysis of Algorithms	3	1	0	4	4
5	MCAP2105	Optimization Techniques	3	1	0	4	4
<b>Total Theory</b>						<b>20</b>	<b>20</b>
<b>B. Laboratory</b>							
6	MCAP2111	Object Oriented Programming Lab	0	0	4	4	3
7	MCAP2112	DBMS II Lab	0	0	4	4	3
<b>Total Practical</b>						<b>8</b>	<b>6</b>
<b>Total of Semester</b>						<b>28</b>	<b>26</b>

## FOURTH SEMESTER

<b>A. Theory</b>							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP2201	Computer Communication Networks	3	1	0	4	4
2	MCAP2202	Web Technology	3	1	0	4	4
3	MCAP2203	Artificial Intelligence and Applications	3	1	0	4	4
4	MCAP2250- MCAP2253	Elective I	3	1	0	4	4
	MCAP2250 MCAP2251 MCAP2252 MCAP2252	Soft Computing Mobile Computing Compiler Design Management Support System					
5	MCAP2260- MCAP2263	Elective II	3	1	0	4	4
	MCAP2260 MCAP2261 MCAP2262	Advanced UNIX Programming Cloud Computing Cryptography and Network Security					
	MCAP2263 MCAP2264	Ecommerce and ERP Foundations of Decision Processes					
<b>Total Theory</b>						<b>20</b>	<b>20</b>
<b>B. Laboratory</b>							
6	MCAP2211	Computer Network Lab	0	0	4	4	3
7	MCAP2212	Web Technology Lab	0	0	4	4	3
<b>Total Practical</b>						<b>8</b>	<b>6</b>
<b>C. Sessional</b>							
8	HMTS2221	Career Development and Management	0	0	3	3	2
<b>Total Sessional</b>						<b>3</b>	<b>2</b>
<b>Total of Semester</b>						<b>31</b>	<b>28</b>

**THIRD YEAR  
FIFTH SEMESTER**

<b>A. Theory</b>							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP3101	Software Engineering	3	1	0	4	4
2	MCAP3102	Computer Graphics and Multimedia	3	1	0	4	4
3	MCAP3150- MCAP3153	Elective III	3	1	0	4	4
	MCAP3150	Distributed Database Management					
	MCAP3151	Machine Learning					
	MCAP3152	Management of Software Projects					
	MCAP3153	Blockchain Technology & Applications					
4	MCAP3160- MCAP3163	Elective IV	3	1	0	4	4
	MCAP3160	Image Processing					
	MCAP3161	Data Mining & Data Warehousing					
	MCAP3162	Managerial Economics					
	MCAP3163	Internet of Things					
<b>Total Theory</b>						<b>16</b>	<b>16</b>
<b>B. Laboratory</b>							
5	MCAP3111	CASE Tools Lab	0	0	4	4	3
<b>Total Practical</b>						<b>4</b>	<b>3</b>
<b>C. Sessional</b>							
6	MCAP3195	Minor Project and Seminar	0	0	12	12	9
<b>Total Sessional</b>						<b>12</b>	<b>9</b>
<b>Total of Semester</b>						<b>32</b>	<b>28</b>

### **SIXTH SEMESTER**

<b>A. Sessional</b>							
Sl.	Code	Subject	Contacts Periods/Week				Credit Points
			L	T	P	Total	
1	MCAP3295	Major Project & Seminar	0	0	29	29	24
2	MCAP3296	Comprehensive Viva	0	0	0	0	4
<b>Total Sessional</b>						<b>0</b>	<b>28</b>
<b>Total Semester</b>						<b>29</b>	<b>28</b>

### **Subject Category-wise Credit Summary for MCA Programme (Excluding Project and Comprehensive Viva)**

Sl. No.	Course Type	Credit from Compulsory Courses	Credit from Elective Courses (Max)
1	Business Management including Humanities	11	16
2	Information Technology	79	16
3	Mathematics	16	0

### **Semester-wise Credit Summary for MCA Programme**

Semester No.	Contact hr/wk	Credit
1	26	24
2	32	29
3	28	26
4	31	28
5	32	28
6	29	28
<b>Total</b>		<b>163</b>

## **PART II : DETAILED SYLLABUS**

**Syllabus of 1<sup>st</sup> semester:**

<b>Paper Name: INTRODUCTION TO PROGRAMMING</b>					
<b>Paper Code: MCAP1101</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Understand the flow of control in order to solve a real time problem.
2. Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
3. Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
4. Understand the programming constructs in order to solve a problem of given nature.
5. Apply high-level language to automate the solution to a problem.
6. Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

### **Module I [10L]**

**Introduction:** History of Computing, Evolution of Programming Languages, Compilers, Familiarization with UNIX.

**Problem Solving Method:** Algorithm, Flowchart, Problem-Solving Methodology- Tools, Pseudocode.

**Overview of C language:** C Standards, Structure of a C Program, C Libraries, Steps of Compilation of a C Program.

**Expressions:** Basic Data Types, Variables, Type Qualifiers, Storage Class Specifiers, Variable Scopes, Constants, Operators, Operator Precedence, Expression Evaluation, Type Conversion in Expressions, Type Casting.

**Console I/O:** Reading and Writing Characters, Reading and Writing Strings, Formatted Console I/O.

### **Module II [10L]**

**Control Statements:** Selection Statements (if, switch-case), Iteration Statements (for loop, while loop, do-while loop), Jumping Statements (return, goto, break, exit, continue).

**Function:** Functions and Modular Programming, General Form, Function Prototypes, Library Functions, Parameter Passing Mechanisms, Storage Classes, Recursive function.

### **Module III [10L]**

**Arrays and Strings:** Single Dimension Arrays, Two Dimension Arrays, Multidimensional Arrays, Strings, Arrays of Strings, String Library Functions.

**Pointer:** Pointers and Memory Addressing. Pointer Variables, Pointer Arithmetic, Pointer Expressions, Pointers and Arrays, Functions and Pointers, Dynamic Memory Allocation, Command Line Arguments.

#### **Module IV [10L]**

**Structures, Unions, Enumerations:** Structures, Arrays of Structures, Structure and Pointers, Unions, Bit Fields, Enumerations, typedef keyword.

**File I/O:** Concept of Files, File operations, Text Files and Binary Files.

**The Preprocessor:** Preprocessor Directives, Macros, File Inclusion.

#### **Text Books:**

1. Programming with C - Gottfried, TMH.
2. Programming in C - Balagurusamy, Tata McGraw Hill.
3. Programming in C – Reema Thareja, Oxford University Press.

#### **Reference Books:**

1. C Programming Made Easy - Raja Ram, SCITECH.
2. The C Programming Language - Kernighan Ritchie, PHI.

<b>Paper Name: MATHEMATICAL FOUNDATIONS</b>					
<b>Paper Code: MCAP1102</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Understand the basics of Mathematical Logic and how that can be abstracted through logical variables and connectives.
2. Develop the concept of Graphs and their properties with respective algorithms to explore some of the fundamental ideas of Computer Science.
3. Combine the ideas of Permutation & Combination to solve some real world computational problems.
4. Analyze the nature of generating functions and recurrence relations.
5. Understand the Boolean Algebra and its inner working for lower level computation.
6. Develop the basic idea of Automata theory and its significance for the modern theory of Computational Linguistics.

### **Module I [10L]**

**Mathematical Logic:** Propositions, Connectives, Conditionals and Biconditionals, Well-formed formulas (WFF), Tautologies, Equivalence formulas, Law of duality, Normal Forms, Predicate Calculus, Free and Bound variables.

**Abstract Algebra:** Set, Relations and Well-ordering principle, Functions. Algebraic structures, Semi-group, Group, Subgroup, Order of a group, Cyclic-group, Homomorphism. Application of residue arithmetic in computer.

### **Module II [10L]**

**Graph Theory:** Basic Concepts of Graphs-definitions, Walk, Trail, Path, Isomorphic graph, Connected graph, Euler graph. Trees, Forest, Adjacency and Incidence Matrices, Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Shortest Path (Dijkstra's Algorithm), Planar Graph. Storage representation and manipulation of graphs, List-structures. Various applications of Graph Theory in Computer Science.

### **Module III [10L]**

**Permutation and Combination:** Concepts of Permutations and Combinations, Inclusion-Exclusion Principle, Pigeon-hole principle, Euclidean algorithm for Linear Diophantine Equation, Basic Counting Concepts. Formula derangement, Restrictions on relative positions.

**Generating- function and Recurrence relation:** Generating-function, Recurrence-relations, Linear recurrence-relations with constant coefficients, Solution by Generating-function.

## **Module IV [10L]**

**Boolean Algebra:** Definition of Boolean algebra, Boolean function Simplification. SOP and POS forms.

**Mathematical Computing:** Finite Automata – definition and construction, DFA, NFA, NFA to DFA conversion, State-minimization, Mealy M/C, Moore M/C, problem and solution.

**Definition of Grammars:** Unrestricted grammar, Context-sensitive grammar, Context-free grammar, Regular grammar.

### **Text Books:**

1. Discrete Mathematics and Its Applications - KH Rosen, TMH.
2. Elements of Discrete Mathematics -C.L Liu, McGraw Hill.
3. Discrete Mathematical Structure - Kolman, Busby and Ross, PHI.

### **Reference Books:**

1. Discrete Mathematics Theory, Problems and Solutions – Dipendra Nath Ghosh, Academic Publishers.
2. Graph Theory with Application to Engineering and Computer Science - N. Deo, PHI.
3. Theory of Computer Science –K.L.P Mishra and N. Chandrashekharan, PHI.

<b>Paper Name: NUMERICAL ANALYSIS</b>					
<b>Paper Code: MCAP1103</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Develop the ideas of numerical computations and the various types of errors occur in numerical computations.
2. Apply various Algebraic and Transcendental Equations to solve specific problems of numerical computation with their rate of convergency.
3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. Analyze certain real life problems that can be transformed in terms of numerical differentiation and integration.
5. Apply techniques to solve the system of linear equations.
6. Apply various techniques to solve ordinary differential equations.
7. Analyze the basics of approximation theory through least square method.
8. Develop the ideas of various linear and nonlinear curve fitting techniques.

### **Module I [8L]**

**Errors in Numerical Computations:** Computing Arithmetic, Sources of Errors, Significant Figures: Absolute, Relative and Percentage Errors. Significant Digits, Generation and Propagation of Round-off Error.

**Solutions to Algebraic and Transcendental Equations:** Introduction, Bisection Method, Secant Method, Regula Falsi Method, Newton Raphson Method, Iterative or Successive Approximation Method, Comparison of Iterative Methods, Convergence of different methods, Algorithm and Flowchart of different methods.

### **Module II [10L]**

**Interpolation and Polynomial Approximation:** Introduction, Lagrange's Interpolation, Finite Difference Operators, Error in Interpolating polynomial, Interpolation Techniques Based on Finite Differences, Forward and Backward Differences, Newton's Forward Difference Interpolation Method, Newton's Backward Difference Interpolation Method, Inverse Interpolation.

### **Module III [12L]**

**Numerical Differentiation and Integration:** Introduction, Differentiation based on Newton's Forward and Backward Interpolation Formula, Different Operators, Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule, Errors in Integration Formulae, Algorithm and Flowchart of different methods.

**Solutions to System of Linear Equations:** Introduction, Gauss Elimination Method, Gauss Jordan Elimination Method, Triangularization or LU Decomposition Method, Jacobis Iteration Method, Gauss Seidel Iterative Method, Comparison and choice of Methods, Eigen-Value problem, Algorithm of different methods.

## **Module IV [10L]**

**Solutions to Ordinary Differential Equation:** Introduction, Taylor Series Method, Euler's Method, Modified Euler's Method, Runge Kutta Method, Algorithm of different methods.

**Approximation Theory:** Least Square Approximation.

**Curve Fitting:** Curve Fitting using Least Square Method – Linear, Quadratic, Cubic, and Exponential.

### **Text Books:**

1. Introductory Numerical Analysis – Dutta and Jana, Shreedhar Prakashani.
2. Introductory Methods of Numerical Analysis - S. S. Sastry, PHI

### **Reference Books:**

1. Computer Oriented Numerical Methods - V. Rajaraman, PHI
2. Numerical Analysis and Computational Procedures - S. Ali Mollah, Books & Allied Ltd.
3. Numerical Mathematical Analysis - James B. Scarborough, Oxford.

<b>Paper Name: ACCOUNTING AND MANAGEMENT CONTROL</b>					
<b>Paper Code: HTMS1101</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

### **Course Outcomes:**

1. Understanding the role and purpose of accounting.
2. Ability to prepare, interpret and analyze financial statements.
3. Understanding the various methods of costing and ability to use costing techniques for decision making.
4. Use of budgetary control, standard cost and variance analysis.
5. Thorough knowledge of Management Control Systems that are used to run businesses.
6. Analyze and prepare business data to facilitate management understanding and action.
7. Idea of efficient allocation of organizational resources during budgeting process.
8. Appreciating the need of management reporting for decision making.
9. Understanding Management Control System for different types of organizations.

### **Module I [8L]**

- i. Double entry system of book keeping – Basic accounting equation
- ii. Meaning of assets, liabilities, equity, revenue, expenses
- iii. Accounting concepts and conventions
- iv. Inventory valuation (FIFO, LIFO, Simple Average, Weighted Average method)
- v. Accounting concept and methods of computing depreciation (SLM, WDV)

### **Module II [12L]**

- i. Accounting Cycle - Journal, Ledger and Trial Balance
- ii. Preparation of Final Accounts with common adjustments for public limited companies.

### **Module III [12L]**

- i. Objectives and importance of Cost Accounting
- ii. Basic cost concepts - cost classification; allocation; apportionment; absorption,
- iii. Break-even analysis
- iv. Decisions based on marginal costing – relevant cost; make or buy; product mix
- v. Standard costing – Material, Labour, Sales.
- vi. Budgets – meaning; benefits, types.

### **Module IV [8L]**

- i. Management control system-nature, characteristics.
- ii. Understanding the concept of strategy, goals, key variables.
- iii. Responsibility centers, revenue centers, expense centers, profit centers-concepts.
- iv. Transfer pricing – concept and methods
- v. Organizational relationships in control - hierarchy, span of control.
- vi. Management Reporting System - need, essentials of an effective MR system, MBO.
- vii. Budgeting as a tool for management control

- viii. Management Control of: Service Organizations; Non-Profit Organizations; MNCs; Projects

**Text Books:**

1. Management: A Systems Approach - Koontz and O'Donnel, TMH.
2. Financial Accounting - PC Tulsian, Pearson Education.
3. Management Accounting - I.M. Pande, VIKAS.

**Reference Books:**

1. Management Techniques: A Practical Guide - John Argenti.
2. Management: A Global Perspective - Wehrich and Koontz, TMH.
3. Management Accounting - Khan & Jain, TMH.

<b>Paper Name: ORAL AND WRITTEN COMMUNICATIONS</b>					
<b>Paper Code: HTMS1102</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>

### **Course Outcomes:**

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.

### **Module I [10L]**

**Communication Skill :** Definition, nature & attributes of Communication, Process of Communication, Models or Theories of Communication, Types of Communication, Levels or Channels of Communication, Barriers to Communication.

### **Module II [10L]**

**Business Communication:** Scope & Importance, Writing Formal Business Letters, Writing Reports, Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular, Project Proposal, Technical Report Writing, Organizing e-mail messages, E-mail etiquette, Tips for e-mail effectiveness.

### **Module III [10L]**

**Language through Literature:** Modes of literary and non-literary expressions, Excerpts from literary texts (prose, verse and drama), Using language for communication at various cultural and social settings, Descriptive, narrative and expository writing, Writing with a purpose, Writing essays/articles – logical organization of thoughts.

### **Module IV [10L]**

**Communication skills at Work:** Communication and its role in the workplace, Benefits of effective communication in the workplace, Common obstacles to effective communication.

**Approaches and Communication techniques for multiple needs at workplace:** persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections.

### **Text Books:**

1. Theories of Communication: A Short Introduction - Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan - Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Business English - Hauppauge, Geffner, Andrew P., New York: Barron's Educational Series.

**Reference Books:**

1. Writing and Speaking at Work: A Practical Guide for Business Communication - Edward P.Bailey, Prentice-Hall.
2. Business and Administrative Communication - Kitty O. Locker, McGraw-Hill/ Irw
3. Intercultural Business Communication - Lillian Chaney and Jeanette Martin, Prentice Hall.

<b>Paper Name: PROGRAMMING LAB</b>					
<b>Paper Code: MCAP1111</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>3</b>

**Software to be used: GNU C Compiler (GCC) with LINUX**

**NB: Cygwin (Windows based) may be used in place of LINUX**

**Course outcomes:**

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

**Problems related to the following topics:**

Topic 1: LINUX commands and LINUX based editors,

Topic 2: Basic Problem Solving,

Topic 3:Control Structures,

Topic 4:Array (1-d, 2-d),

Topic 5:Functions,

Topic 6:Dynamic Memory Allocation,

Topic 7:String Handling,

Topic 8:Structure and Union,

Topic 9:File Handling.

<b>Paper Name: COMMUNICATIONS LAB</b>					
<b>Paper Code: HMTS 1112</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>3</b>

### **Course Outcomes:**

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

### **Module I**

#### **Formal verbal communication:**

- Introduction to formal verbal communication, Interpersonal Skills & Public Speaking: Building Positive Relationships, Focusing on Solving Problems, Time Management, Dealing with Criticism: Offering Constructive Criticism, Responding to Criticism – Managing Conflict: Approaches to Conflict, Resolving Conflict
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

### **Module II**

#### **Presentation skills:**

- Speech Purposes - General: Informative Speeches, Persuasive Speeches, Entertaining Speeches, Methods of Speaking: Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organising the Presentation: the Message Statement, Organising the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium, Post-presentation Discussion

### **Module III**

#### **Group Discussion:**

Introduction to Group Communication, Factors in Group Communication, Status – Group Decision Making: Reflective Thinking, Brainstorming, The Planning Process, Strategies for Successful GDs, Role of Social Awareness (Newspapers, Magazines, Journals, TV News, Social Media), Body Language, Logical Argument, Practice GDs

## **Module IV**

### **Job Application and Personal Interview:**

- Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of Well-Written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section
- Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination Chronological and Functional Resume – Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References
- Interviewing: Types of Interviews, Format for Interviews: One-to-one and Panel Interviews, Employment Interviews, Frequently Asked Questions, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews

## Syllabus of 2<sup>nd</sup> semester:

Paper Name: COMPUTER ORGANIZATION AND ARCHITECTURE					
Paper Code: MCAP 1201					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

### Course Outcomes:

1. Understand Binary Number system, and logic design using basic logic gates and universal gates.
2. Able to design applications of Sequential Circuits.
3. Able to design Finite State Machines.
4. Understand the basic organization of computer and different instruction formats and addressing modes.
5. Analyze the concept of pipelining, vector-processing , segment registers and pin diagram of CPU.
6. Understand and analyze various issues related to memory hierarchy and memory mapping technologies.
7. Understand various modes of data transfer between CPU and I/O devices.

### **Module I [10L]**

**Boolean Algebra & Logic Gates:** Logic gates- truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, Kmap method.

**Combinational Circuits:** Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Multiplexer, De-Multiplexer and Parity Generator.

### **Module II [10L]**

**Sequential Circuits:** Sequential Circuits - Basic memory element - S-R, J-K, D and T flip flops; Registers and counters and their design, Irregular counter, State table and state transition diagram; Sequential circuits design methodology.

**Instruction Formats:** Introduction to basic structures and operational concepts, Instruction formats, Instruction execution, sequencing, Addressing modes .

### **Module III [10L]**

**Control Unit:** Concepts, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction, Hardwired control, Microprogrammed control.

**Memory:** Basic concepts, RAM, ROM – different types, Characteristics, Memory design (Linear addressing, interleaved memory) Cache memories, Performance (memory interleaving, hit rate etc.), Memory hierarchy - virtual memory – address translation, Secondary memories Data transfer through programmed I/O, interrupt and DMA, I/O processors.

## **Module IV [10L]**

**Input/output organization:** Memory mapped, standard (isolated) and linear selection techniques of I/O addressing.

**Pipelining:** Arithmetic & instruction, speedup, vector processing, array processor, Introduction to RISC processor and parallel processing, Bit-Slice processors.

### **Text Books:**

1. Digital Logic and Computer Design - M. Morris Mano, Pearson.
2. Computer System Architecture - Morris Mano, PHI.
3. Digital Logic Design – MansafAlam, Bashir Alam, PHI.

### **Reference Books:**

1. Computer Organization – C. Hamacher, Z. Vranesik, S. Zaky, McGraw Hill.
2. Computer Architecture and Organization – John P. Hayes, McGraw Hill.
3. Digital Design: Basic Concepts and Principles - Mohammad A. Karim, CRC Press.

<b>Paper Name: DATA STRUCTURES</b>					
<b>Paper Code: MCAP1202</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course outcomes:**

1. Understand and remember the basics of data structures and Abstract data type (ADT).
2. Understand the significance and utility of different data structures and the context of their application.
3. Apply different types of data structures in algorithms and understand how the data structures can be useful in those algorithms.
4. Evaluate solutions of a problem with different data structures and thereby understand how to select suitable data structures for a solution. (For example, what are the different ways to find the second largest number from a list of integers and which solution is the best.)
5. Evaluate different types of solutions (e.g. sorting) to the same problem.

### **Module I [8L]**

**Introduction:** Concepts: Datatype and data structure, Abstract Data Type. Classification, Algorithms concepts. Analysis: space and time analysis of algorithms – Big O,  $\Theta$ ,  $\Omega$  notations.

**Array:** Different representations – row major, column major. Sparse matrix – its implementation and applications. Array representation of polynomials.

**Linked List:** Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

### **Module II [8L]**

**Stack and Queue:** Stack - implementation using array and linked list. Applications. Queue, circular queue, deque - implementation using array and linked list. Applications.

**Recursion:** Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi.

### **Module III [12L]**

**Graphs:** Graph representations / storage – using adjacency matrix, adjacency list.

**Trees:** Basic Terminologies, tree representation – using array and linked list. Binary trees: traversal (pre-, in-, post-, level- order). Threaded binary trees. Huffman trees. Heaps – implementation of priority queue. Binary Search trees, AVL tree (insertion, deletion with examples only), B-tree (insertion, deletion with examples only), Trie (insertion, deletion with examples only).

## **Module IV [12L]**

**Searching:** Sequential, Binary. Complexity analysis and comparison.

**Sorting:** Introduction – idea about internal and external sorting, in-place sorting, stability, adaptivity. Sorting algorithms - Bubble, Insertion, Selection, Shell, Quick, Merge, Heap, Radix. Complexity analysis (Average case analysis not required), and comparison.

**Hashing:** Hash Functions. Collision resolution – open and closed hashing.

### **Text Books:**

1. Classic Data Structures - Debasis Samanta, PHI Learning.
2. Data Structures and Program Design in C - Robert L Kruse, Bruce P. Leung, Pearson Education.
3. Data Structures using C - Aaron M Tenenbaum, Moshe J Augustein, Pearson Education.

### **Reference Books:**

1. Data Structures -Seymour Lipshutz, McGraw Hill.
2. Fundamentals of Data Structures in C -Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Universities Press.

<b>Paper Name: DATABASE MANAGEMENT SYSTEMS I</b>					
<b>Paper Code: MCAP1203</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Understand and describe data models and schemas in DBMS.
2. Understand the features of database management systems and Relational database.
3. Apply relational algebra and calculus to interpret data in relational format.
4. Apply SQL the standard language of relational databases.
5. Analyze the functional dependencies and design of the database.
6. Understand the concept of storage for various forms of data.
7. Develop the concept of different levels of indexing to optimize query processing.

### **Module I [10L]**

**Introduction to DBMS:** Basic Concepts of Operational Data, Data vs Information, Introduction to Database and DBMS, Importance of Database Design, Files and File Systems, Problems with File System Data Management, Database Systems, Views of Data, Three-Level Architecture, Instances and Schemas, Database Administrator, Database Users, Advantages and Disadvantages of DBMS.

**Data Model:** Data Modeling and Data Models, Importance of Data Models, Data Model Basic Building Blocks, The Evolution of Data Models, Degree of Data Abstraction.

**Entity-Relationship Modeling:** Entity and Entity Instances, Attributes, Entity Relationships, Cardinality of Relationships, Strong and Weak Entity, Generalization, Specialization, Aggregation, Developing an ER Diagram, Entity Integrity and Primary Key, Translating ER Model into Relational Model.

### **Module II [10L]**

**Relational Model:** A Logical View of Data, Keys, Integrity Rules, Relational Set Operators, Data Dictionary and the System Catalog, Relationships within the Relational Database, Data Redundancy Revisited, Indexes, Codd's Relational Database Rules.

**Relational Database Design:** Functional Dependency (FD) –Definition, Trivial and Non-Trivial FD, Closure of Set of FD, Closure Of Attribute Sets, Irreducible Set of FD, Canonical Cover, Normalization – 1NF, 2NF, 3NF,BCNF, Decomposition using FD, Lossless Decomposition, Dependency Preservation.

### **Module III [10L]**

**Relational Algebra:** Select Operation, Project Operation, Join Operation, Division Operation, Cross Product Operation, Set operations.

**Relational Calculus:** Introduction, Tuple Relational Calculus, Operators used in TRC, Example queries using TRC, Domain Relational Calculus, Operators used in DRC, Example queries using DRC, Comparison of TRC, DRC, RA.

**Structured Query Language (SQL):** Introduction to SQL, DDL, DML, DCL, Basic Structure, Basic Queries, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, Assertions, Views, Joining Database Tables, Commit, Rollback.

#### **Module IV [10L]**

**Advanced SQL:** Subqueries and Correlated Queries, SQL Built in Functions - Numeric, Date, String Functions, Updatable Views.

**Storage structure:** Sequential and indexed file organization, B+ tree - creation, insertion & deletion.

**Indexing:** Primary, Secondary & Multi Level.

#### **Text Books:**

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH.
2. Fundamentals of Database Systems - Elmsari and Navathe, Addison-Wesley.

#### **Reference Books:**

1. An Introduction to Database Systems - Date C. J, Addison-Wesley.
2. SQL-PL/SQL - Ivan Bayross, BPB.

<b>Paper Name: INFORMATION SYSTEM ANALYSIS DESIGN AND IMPLEMENTATION</b>					
<b>Paper Code: MCAP1204</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Understand the idea of information system in lieu of the modern abstraction of data.
2. Analyze various phases of system development life cycle.
3. Gather data to analyse and specify the requirements of a system.
4. Design system components and environments.
5. Analyze the feasibility of a project.
6. Deliver various types of system documentation.

### **Module I [10L]**

**Data and Information:** Types of information: operational, tactical, strategic and statutory. Why do we need information systems? Requirement of information at different levels of management, Requirement of information for various functions. Quality of information.

**Systems Analysis and Design Life Cycle:** System definition and concepts, system environments and boundaries. Real time and distributed systems, basic principles of successful systems. Role and attributes of a systems analyst. Requirements determination, requirements specifications, feasibility analysis, final specifications, hardware and software study, system design, system implementation, system evaluation, system modification.

### **Module II [10L]**

**Information gathering:** Strategies and methods. System requirements specification.

**Feasibility analysis:** Deciding project goals, examining alternative solutions, cost–benefit analysis, quantifications of costs and benefits, payback period, system proposal preparation for managements, parts and documentation of a proposal, tools for prototype creation.

**Data flow diagrams:** Rules and conventions, levels of DFDs, logical and physical DFDs. Software tools to create DFDs.

### **Module III [10L]**

**Structured systems analysis and design:** Procedure specifications in structured english, decision tables for complex logical specifications, Specification oriented design vs. Procedure oriented design.

**Data oriented systems design:** Entity relationship model, E-R diagrams, relationships, cardinality and participation, normalizing relations and their use.

**Coding practices:** Coding techniques, requirements of coding schemes, error detection of codes.

**Data input methods:** Input Design, validating input data, input data controls, interactive data input.

**Designing outputs:** Designing output reports- screen design, graphical user interfaces, interactive I/O on terminals.

**Form design:** Classification of forms, requirements of form design, Types of forms, Layout considerations, Form control.

#### **Module IV [10L]**

**System control:** Need for controls, objectives of controls, techniques used in controls, Gantt chart, PERT.

**System implementation and maintenance:** Planning considerations. Conversion methods, procedures and controls. System acceptance criteria. System Evaluation and Performance. Testing and Validation. Preparing User Manual. Maintenance Activities and Issues.

**System audit and security:** Audit of Computer System Usage. Types of Threats to Computer System and Control Measures, Threat and Risk Analysis, Disaster Recovery and Contingency Planning, Viruses.

#### **Text Books:**

1. Software Engineering: A Practitioner's Approach - Roger. S. Pressman, 7th Edition, Tata McGraw Hill.
2. Systems Analysis and Design - Kendall, Kenneth E and Julie E. Kendall, 7th Edition, Prentice Hall of India.
3. Systems Analysis & Design - Alan Dennis, Barbara H. Wixom and Roberta M Roth, 4th Edition, Wiley & Sons.

#### **Reference Books:**

1. System and Design Methods - Jeffrey, L. Whitten and Lonnie D. Bentley, 6th Edition, Tata McGraw Hill
2. Modern Systems Analysis and Design - Jeffrey A. Hoofer, Joey F. George and Joseph S. Valacich, 5th Edition, Pearson Education.
3. Systems Analysis and Design Techniques, Methodologies, Approaches, and Architectures - Roger H.L.Chinan, Keng Siau, and Bill C. Hardgrave, 1st Edition, Prentice Hall of India.

<b>Paper Name: PROBABILITY AND STATISTICAL COMPUTING</b>					
<b>Paper Code: MCAP1205</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>4</b>

### **Course Outcomes:**

1. Demonstrate the knowledge of probabilistic approaches to solve wide range of problems.
2. Recognize probability distribution for discrete and continuous variables to quantify physical phenomena.
3. Appreciate the importance of probability and statistics in computing and research.
4. Understand basic statistical inference techniques for drawing inferences on real life data.
5. Use appropriate statistical methods in the analysis of simple datasets.
6. Interpret and clearly present output from statistical analyses in a clear concise and understandable manner.

### **Module I [10L]**

**Probability:** Random Experiment, Sample Space, Random Events, Probability of Events, Probability of Non-Disjoint Events (Theorems), Counting Techniques Applied to Probability Problems. Conditional Probability, Stochastic Independence of Events, Bayes' Theorem and Related Problems.

### **Module II [10L]**

**Random Variable and Probability Distribution:** Concept of Random Variables, Probability Mass Function, Probability Density Function and Distribution Function. Expectation and Variance, Moment Generating Function, Chebyshev's Inequality (statement) and Related Problems. Binomial, Poisson, and Normal Distributions.

### **Module III [10L]**

**Sampling and Estimation:** Sampling: Population, Sample, Random Sampling, Statistic and its Distribution, Standard Error of Statistic, Sampling Distribution of Sample Mean and Variance in Random Sampling from a Normal Distribution (statement only) and Related Problems.

Estimation of Parameters: Point Estimation, Unbiased, Minimum Variance Unbiased and Consistent Estimators, Interval Estimation, Maximum Likelihood Estimation and Related Problems.

### **Module IV [10L]**

**Testing of Hypothesis:** Simple and Composite Hypothesis, Critical Region, Level of Significance, Type I and Type II Errors, Power of a Test, Unbiased Tests, Neyman-Pearson Theorem (proof not required), Application to Normal Population, Likelihood Ratio Test (proof not required), Comparison of Binomial and Normal Populations, Testing of Equality of Means  $\chi^2$  - Test for Goodness of Fit.

**Text Books:**

1. A First Course in Probability - S. Ross, Collier Macmillan.
2. Statistical Methods (Volume 1 and 2) – N. G. Das, TMH.

**Reference Books:**

1. Mathematical Statistics – S.C. Gupta and V. K. Kapoor, S. Chand.
2. Engineering Mathematics: Volume IIIA – B. K. Pal & K. Das, U. N. Dhur & Sons Pvt. Ltd.
3. Introduction to Mathematical Statistics - Hogg, McKean and Craig, American Publishing.
4. Statistical Analysis: A Computer Oriented Approach - A. A. Afifi, Academic Press.

<b>Paper Name: DIGITAL LOGIC AND COMPUTER ARCHITECTURE LAB</b>					
<b>Paper Code: MCAP 1211</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>3</b>

### **Course Outcomes:**

1. Use the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method etc.
2. Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.
3. Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).
4. Realize different logic circuits using ICs built with various logic families.

### **Problems related to the following topics:**

Topic 1: Realization of AND, OR, NOT, NAND, XOR gates using respective chips. Design AND, OR gates using basic design elements (Diod, Resistance, Transistor etc.),

Topic 2: Implementation of AND, OR, NOT, XOR gates using NAND Gate as a Universal Gate. Realize the following equation using only minimum number of NAND gates  

$$Y = B'C' + A'BC,$$

Topic 3: Design Half Adder & Full Adder Circuits using basic Gates,

Topic 4: Design Half Subtractor & Full Subtractor Circuits using basic Gates,

Topic 5: Design Adder-Subtractor Composite circuit,

Topic 6: Design and implementation of 16 bit odd/even parity checker / generator using IC74180,

Topic 7: Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147,

Topic 8: Realization of 4:1 & 2:1 MUX Chips. Implement a 8:1 MUX using 4:1 MUXs,

Topic 9: Design S-R, D, J-K Flipflop,

Topic 10: Design and implementation of 3-bit synchronous up/down counter,

Topic 11: Horizontal expansion of RAM,

Topic 12: Vertical expansion of RAM.

<b>Paper Name: DATA STRUCTURES LAB</b>					
<b>Paper Code: MCAP1212</b>					
<b>Contact hrs. per week</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>3</b>

**Course Outcomes:**

1. To understand linear and non-linear data structures.
2. To understand different types of sorting and searching techniques.
3. To know how to create an application specific data structures.
4. To solve the faults / errors that may appear due to wrong choice of data structure.
5. To analyze reliability of different data structures in solving different problems.

**Problems related to the following topics:**

Topic 1: 1-D and 2-D array,

Topic 2: Linked List (Singly linked list, Circular Linked List, Doubly Linked List),

Topic 3: Stack and Queue implementation using array and linked list,

Topic 4: Implementation of different recursive algorithms,

Topic 5: Implementation of Binary Search Tree (insertion, deletion, searching, traversals),

Topic 6: Different searching and sorting algorithms.

<b>Paper Name : DBMS I Lab</b>					
<b>Paper Code: MCAP1213</b>					
<b>Contact hrs per week:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>	<b>Credit Points</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>3</b>

### **Course Outcomes:**

1. Apply the RDMS cocepts to create various schema and instances in terms tables.
2. Populate the relation of tables with proper restriction through keys.
3. Retrive specific data from table/sthrough subquery.
4. Filter data from joing various tables.
5. Use proper data control language to restrict the accessibility of data.

### **Problems related to the following topics:**

#### Topic 1: Database Creation

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

#### Topic 2: Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

#### Topic 3: Retrieving Data from a Database

- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

#### Topic 4: Clause

- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

#### Topic 5: Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE