SCHEME OF INSTRUCTION AND DETAILED SYLLABUS FOR MCA IN DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Effective from 2025 Batch Onwards

NATIONAL INSTITUTE OF TECHNOLOGY DELHI
(An autonomous Institute under the aegis of the Ministry of Education, Govt. of India.)

Phone: 011 3386 1005 Website: www.nitdelhi.ac.in

National Institute Of Technology Delhi

Department of Computer Science & Engineering

Vision and Mission Statements

Vision

To communicate quality Computer Science education for producing globally identifiable technocrats and entrepreneurs, upholding sound ethics, profound knowledge, and innovative ideas to meet industrial and societal expectations.

Mission

M1: To impart value-based technical knowledge and skill relevant to Computer Science and Engineering through effective pedagogies and hands-on experience on the latest tools and technologies to maximize employability.
M2: To strengthen multifaceted competence in allied areas of Computer Science in order to nurture creativity and innovations to adapt to the ever-changing technological scenario, requiring communally cognizant solutions.
M3: To create an appetite for research that leads to pursuing a research career or higher education in contemporary and emerging areas of computer science.
M4: To inculcate the moral, ethical, and social ideals essential for prosperous nation-building.

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Program Educational Objectives (PEOs)

PEO-1	Post Graduates will establish themselves as competent professionals in the computing industry or allied sectors by applying their knowledge in software engineering, application development, and secure system design to address societal and industrial challenges
PEO-2	Post Graduates will effectively utilize data analytics, machine learning, and artificial intelligence tools to interpret complex datasets and drive strategic decisions across diverse application domains.
PEO-3	Post Graduates will engage in advanced studies, cutting-edge research, or innovative entrepreneurial ventures in areas such as cloud computing, cybersecurity, blockchain, or emerging technologies, contributing to the growth of the IT ecosystem.
PEO-4	Post Graduates will demonstrate ethical integrity, effective communication, teamwork, and leadership skills while embracing lifelong learning to adapt to evolving technologies and global work environments.

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Department of Computer Science & Engineering

Program Outcomes (POs)

PO-1	**Computational Knowledge & Problem Solving:** Apply mathematical foundations, computing principles, and domain knowledge to model and solve real-world problems.
PO-2	**Software Design & Development:** Design, develop, test, and deploy robust software solutions that effectively address complex societal and business challenges while considering usability, performance, and sustainability..
PO-3	**Data Analytics & Insight Generation:** Critically analyse data to uncover patterns, generate actionable insights, and build predictive, evidence-based models.
PO-4	**Secure, Reliable & Sustainable Systems**: Engineer, deploy, and manage secure, reliable, and sustainable computing systems within realistic economic, environmental, and resource constraints.
PO-5	**Communication & Team Collaboration:** Communicate ideas and results clearly, and collaborate effectively in multidisciplinary teams, fostering a cooperative and high-performance work culture.
PO-6	**Ethics, Lifelong Learning & Leadership:** Uphold professional ethics, embrace lifelong learning, and provide leadership that drives continuous technological

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Program Specific Outcomes (PSOs)

PSO-1	Software Engineering and Application Development: Design, develop, test, deploy, and maintain efficient, scalable, and secure software solutions by applying modern programming paradigms, development methodologies, and quality-assurance practices for industrial and societal needs.
PSO-2	Data and Intelligence Systems: Analyse complex datasets and apply data- science, machine-learning, and artificial-intelligence techniques to uncover actionable insights and build intelligent systems that solve real-world problems.
PSO-3	Advanced Computing and Research Orientation: Demonstrate competence in advanced areas such as cloud computing, cybersecurity, blockchain, and pursue innovative research to contribute to the evolving IT ecosystem.

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Semester I

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CALM 101	Discrete Mathematics	3	1	0	4	DC
2.	CALM 102	Accounting and Financial Management	3	0	0	3	DC
3.	CABM 103	Problem Solving and Computer Programming	3	0	2	4	DC
4.	CABM 104	Web Technologies	3	0	2	4	DC
5.	CABM 105	Digital Logic and Computer Organization	3	0	2	4	DC
6.	CAPM 106	Seminar I	0	0	2	1	
		Total	**15**	**3**	**4**	**20**	

Semester II

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CALM 151	Probability and Statistics	3	1	0	4	DC
2.	CABM 152	Software Engineering	3	0	2	4	DC
3.	CABM 153	Data Structures	3	0	2	4	DC
4.	CABM 154	Programming using Python	1	0	2	2	DC
5.	CALM 155	System Programming	3	1	0	4	DC
6.	CAPM 100	Mini Project	0	0	4	2	
	Total		**13**	**2**	**10**	**20**	

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Semester III

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CABM 201	Operating Systems	3	0	2	4	DC
2.	CALM 202	Organizational Behaviour	3	0	0	3	DC
3.	CABM 203	Artificial Intelligence	3	0	2	4	DC
4.	CABM 204	Computer Networks	3	0	2	4	DC
5.	CABM XXX	Elective-I (Bouquet I)	3	0	2	4	DE
6.	CAPM 205	Term Paper	0	0	2	1	
	Total		**13**	**2**	**10**	**20**	

Semester IV

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CABM 251	Database Management Systems	3	0	2	4	DC
2.	CABM 252	Design and Analysis of Algorithms	3	0	2	4	DC
3.	CABM 253	Machine Learning	3	0	2	4	DC
4.	CALM 254	Elective-II (Bouquet II)	3	0	0	3	DE
5.	CALM 255	Elective-III (Bouquet II)	3	0	0	3	DE
6.	CAPM 200	Project Work (Phase I)	0	0	4	2	
		Total	**15**	**1**	**8**	**20**	

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Semester V

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CABM 301	Data Mining	3	0	2	4	DC
2.	CABM 302	Information Security	3	0	2	4	DC
3.	CALM 303	Theory of Computation	3	1	0	4	DC
4.	CALM XXX	Elective-IV (Bouquet III)	3	0	0	3	DE
5.	CALM XXX	Elective-V (Bouquet III)	3	0	0	3	DE
6.	CAPM 300	Project Work (Phase II)	0	0	4	2	
		Total	**15**	**3**	**4**	**20**	

Semester VI

S. No.	Course Code	Course Title	Teaching Load			Credits	Course Type
			L	T	P		
1.	CAPM 351	Industrial Training	0	0	38	19	
2.	CAPM 352	Seminar II	0	0	2	1	
		Total	**0**	**0**	**40**	**20**	

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Departmental Elective (Bouquet I)

S. No.	Course Code	Course Title	Teaching Load			Credits
			L	T	P	
1.	CABM XXX	Internet of Things	3	0	2	4
2.	CABM XXX	Big Data Management	3	0	2	4
3.	CABM XXX	Biometrics Systems	3	0	2	4
4.	CABM XXX	Computer Graphics	3	0	2	4
5.	CABM XXX	FullStack Development	3	0	2	4
6.	CABM XXX	E-Commerce Technologies and Management	3	0	2	4

Departmental Elective (Bouquet II)

S. No.	Course Code	Course Title	Teaching Load			Credits
			L	T	P	
1.	CALM XXX	Nature-Inspired Algorithms	3	0	0	3
2.	CALM XXX	Statistical Methods for Data Science	3	0	0	3
3.	CALM XXX	Wireless Sensor Networks	3	0	0	3
4.	CALM XXX	Natural Language Processing	3	0	0	3
5.	CALM XXX	Information Storage and Retrieval	3	0	0	3
6.	CALM XXX	Cloud Computing	3	0	0	3
7.	CALM XXX	Modeling and Simulation	3	0	0	3

8.	CALM XXX	Soft Computing	3	0	0	3
9.	CALM XXX	Foundations of Cryptography	3	0	0	3
10.	CALM XXX	Mobile Computing	3	0	0	3
11.	CALM XXX	Multimedia Databases	3	0	0	3
12.	CALM XXX	Game Theory	3	0	0	3
13.	CALM XXX	Biometric Security	3	0	0	3
14.	CALM XXX	Digital Image Processing	3	0	0	3
15.	CALM XXX	Peer-to-Peer Networks	3	0	0	3
16.	CALM XXX	Information Systems Management	3	0	0	3

Departmental Elective (Bouquet III)

S. No.	Course Code	Course Title	Teaching Load			Credits
			L	T	P	
1.	CALM XXX	Augmented and Virtual Reality	3	0	0	3
2.	CALM XXX	Sentiment Analysis	3	0	0	3
3.	CALM XXX	Motion Planning for Robotics	3	0	0	3
4.	CALM XXX	Compiler Design	3	0	0	3
5.	CALM XXX	Blockchain Technology	3	0	0	3
6.	CALM XXX	Computer Vision	3	0	0	3
7.	CALM XXX	Optimization Techniques	3	0	0	3
8.	CALM XXX	Quantum Computing	3	0	0	3
9.	CALM XXX	Digital Forensics	3	0	0	3
10.	CALM XXX	Evolutionary Computing	3	0	0	3

11.	CALM XXX	Multi-Agent Applications	3	0	0	3
12.	CALM XXX	Graph Mining	3	0	0	3
13.	CALM XXX	Social Network	3	0	0	3
14.	CALM XXX	Reinforcement Learning	3	0	0	3
15.	CALM XXX	Deep Learning	3	0	0	3

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Course Title:	**Discrete Mathematics**
Course Code:	**MAVL 101**
L-T-P:	**3-1-0**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Illustrate the basics of discrete mathematics and predicate calculus	Remembering (Level-I)
CO-2	Explain set theory and relations	Remembering (Level-I)
CO-3	Demonstrate the concepts of graph theory and experiment with trees to solve problems like the minimum spanning tree and tree traversals	Applying (Level-III)
CO-4	Develop the concept of functions and recursive function theory	Creating (Level-VI)
CO-5	Illustrate different algebraic structures	Analyzing (Level-IV)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**1**	**1**			**1**									
CO-2	**3**	**1**	**1**												
CO-3	**2**	**3**	**1**										**2**		
CO-4	**3**	**2**				**1**							**1**		
CO-5	**3**		**2**	**1**											**2**

1 - Small extent **2 -** Significantly **3 -** Strongly

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Mathematical reasoning; propositions; negation, disjunction, and conjunction; implication and equivalence; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs; use in program proving; resolution principle.	**5**
Module-II	Set theory; Paradoxes in set theory; inductive definition of sets and proof by induction; Peano postulates; Fuzzy Sets; Relations; representation of relations by graphs; properties of relations; equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets.	**10**
Module-III	Functions; mappings; injections and surjections; composition of functions; inverse functions; special functions; Peano postulates; pigeonhole principle; recursive function theory, Representation of Integers, GCD, residue classes, linear congruence. Euclidean theorem, Chinese remainder theorem, and inclusion-exclusion principle. Binomial coefficients, permutation, and combination.	**7**
Module-IV	Graph Theory: elements of graph theory, Euler graph, Hamiltonian path, trees, tree traversals, spanning trees.	**7**
Module-V	Definition and elementary properties of groups, semigroups, monoids, rings, fields, vector spaces, field introduction to partially ordered sets, and lattices. Elementary combinatorics; counting techniques; recurrence relations; generating functions.	**7**

Learning Resources:

Textbooks:	1. Title- Discrete Mathematics and Applications, Author- .H.Rosen, Publisher- TataMcGraw Hill, Edition- Fifth edition 2003
Reference Books:	1. Title- Elements of Discrete Mathematics, Author- .C.L.Liu, Publisher- McGraw-Hill Book, Edition- Second edition 1985 2. Title- Discrete Mathematics for Computer Scientists and Mathematicians, Author- J .L.Mott, A.Kandel, T.P. Baker, Publisher- Prentice Hall of India, Edition- Second edition 2015 3. Title- Logic and Discrete Mathematics, Author- W.K.Grassmann and J.P.Tremblay, Publisher- Pearson, Edition- 1995
Other Suggested Readings:	

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Accounting and Financial Management**
Course Code:	**CALM 102**
L-T-P:	**3-0-0**
Credits:	**3**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Prepare and analyse the final accounts of the firm	Applying, Analyzing (Level-III, IV)
CO-2	Prepare and analyse the funds & cash flow statements of the firm	Applying, Analyzing (Level-III, IV)
CO-3	Perform basic analysis of financial statements and write a report on the financial performance, conditions and effectiveness of the firm	Analyzing, Evaluating (Level-IV, V)
CO-4	Analyse and evaluate costing systems	Analyzing, Evaluating (Level-IV, V)
CO-5	Prepare different types of budgets and policies	Applying, Creating (Level-III, VI)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**		**2**		**2**	**1**							**1**		
CO-2	**3**		**3**		**2**	**1**							**2**		**1**
CO-3	**2**		**3**		**3**	**1**							**3**		**1**
CO-4	**3**		**2**		**2**	**1**							**2**		
CO-5	**2**		**2**		**2**	**2**							**1**		

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Assets – Liabilities – Types - Trading account – Accounting records and Systems – Limitations - Income statement – Preparation and Interpretation.	**5**
Module-II	Depreciation – Methods - Inventory methods, Sources of working capital, Fund flows, Cash flows – Financial Statement analysis.	**8**
Module-III	Ratio analysis - Use of ratios in interpreting Trading Accounts and Financial Statements, Limitations – Management Accounting.	**7**
Module-IV	Variable costs – Fixed costs – Cost Volume Profit Analysis – Break even marginal and full costing contribution, Standard costing - Analysis of variance - Computer accounting and algorithms.	**8**
Module-V	Characteristics of Budgets - Forecasting – Long term, Short term – Methods of capital investment decision making, Sensitivity Analysis, Cost of capital.	**8**

Learning Resources:

Textbooks:	1. Title- An Introduction to Accountancy, Author- N. Maheswari and S.K. Maheswari, Publisher- Vikas Publishing, New Delhi, Edition- 11th edition, 2013
Reference Books:	1. Title- Principles of Management and Accounting, Author- Manmohan and Goyal, Publisher- SahityaBhawan, Edition- 5th Edition, 1994 2. Title- Management Accountancy, Author- J.Batty, Publisher- Macdonald & Evan Ltd., London, Edition- 3rd Edition, 1970
Other Suggested Readings:	

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Problem Solving and Computer Programming**
Course Code:	**CABM 103**
L-T-P:	**3-0-2**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Illustrate the steps involved in compiling, linking, and debugging any code written in a specific language	Remembering (Level-I)
CO-2	Explain the basic concepts such as keywords, identifiers, header files, and the methods of iteration or looping and branching, etc	Remembering (Level-I)
CO-3	Apply the concepts of functions to understand modular programming	Applying (Level-III)
CO-4	Utilise the concept of pointers and arrays to structure data in a computer program	Applying (Level-III)
CO-5	Develop the basic applications in C programming using structures, unions and file handling	Creating (Level-VI)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**2**			**2**	**1**	**1**							**1**		
CO-2	**3**	**2**		**2**		**2**							**1**		
CO-3	**2**	**3**		**1**		**1**							**2**		
CO-4	**2**	**3**		**1**		**1**							**2**		
CO-5	**3**	**3**		**1**	**1**	**1**							**3**		**1**

1 - Small extent **2 -** Significantly **3 -** Strongly

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Introduction to Computers: Hardware and Software. Basic Model of Computation, Notion of Algorithms, Flowcharts, Top-down design, Bottom-up approaches of problem solving, Number system	**5**
Module-II	Introduction to programming language, Basics of C, Basic Data types – int, float, double, char, Bool, Void. Arithmetic and logical operators: precedence and associativity. Flow of Control- Conditional statements- If-else, Switch-case constructs, Loops- While, do-while, for.	**9**
Module-III	Function – User-defined functions, library functions, Parameter passing – call by value, call by reference, recursion.	**7**
Module-IV	Arrays- Advantages and drawbacks, One-dimensional, Multi-Dimensional Arrays and strings: Declaration, Initialization, Accessing, Passing arrays and strings as parameters to functions. Pointers, Dynamic memory allocation, Dynamic arrays – One-dimensional, Multidimensional dynamic arrays.	**7**
Module-V	Structure: Declaration, Initialisation, passing structure to function, Use of pointers in structure. Preprocessors, Macros, File management in C I/O – Opening, closing, and editing files. Correctness & Efficiency Issues in Programming, Time & Space measures.	**8**

Learning Resources:

Textbooks:	1. Title- Programming in ANSI C, Author- E. Balagurusamy, Publisher- TATA McGraw-Hill, Edition- 6th edition, 2012
Reference Books:	1. Title- Let Us C, Author- Yashavant Kanetkar, Publisher- Infinity Science Press, Edition- 13th edition, 2012 2. Title- The C Programming Language, Author- Brian Kernighan & Dennis Ritchie, Publisher- Prentice Hall, Edition- 2nd Edition, 1988 3. Title- Schaum's Outline of Programming with C, Author- Byron S Gottfried, Publisher- TATA McGraw-Hill, Edition- 2nd edition, 1996
Other Suggested Readings:	

List of Experiments:	
1.	Installation of C Development Environment.
2.	Introduction to Programming Logic Building.
3.	Basic Concepts of a Computer Programming Language.
4.	Implementation of sequential constructs.
5.	Implementation of selection constructs.
6.	Implementation of Iterative constructs and their nested variants.
7.	Implementation of arrays (One-dimensional and multidimensional along with operations performed on arrays).
8.	Implementation of functions (normal functions, recursive functions, and parameter passing methods).
9.	Implementation of Pointers with arrays, strings, and functions.
10.	Implementation of structures and Union.
11.	Implementation of file handling in C.

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Web Technologies**
Course Code:	**CABM 104**
L-T-P:	**3-0-2**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Understand the fundamental concepts of web design and development	Understand (Level-II)
CO-2	Develop interactive and dynamic web applications using JavaScript, handling events, and integrating with HTML elements	Creating (Level-VI)
CO-3	Develop server-side web applications using Perl	Creating (Level-VI)
CO-4	Utilize XML and related technologies to represent, process, and integrate data within web applications	Applying, Analyzing (Level-III, IV)
CO-5	Build dynamic web applications using PHP, AJAX, and integrate with databases	Creating (Level-VI)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**2**	**2**		**1**		**1**							**1**		
CO-2	**2**	**3**		**2**	**1**	**1**							**3**	**1**	
CO-3	**2**	**3**		**2**	**1**	**1**							**3**		**1**
CO-4	**2**	**2**	**1**	**1**		**1**							**2**	**1**	
CO-5	**1**	**3**	**1**	**2**	**1**	**1**							**3**	**2**	**1**

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Web essentials, W3C , Client-Server Communication , Markup Languages , HTML5 – Semantic Elements – Forms – Graphics – Media – CSS, and Different Versions.	**5**
Module-II	Dynamic Web Applications– JavaScript: Basics, Statements, Hierarchy of Objects, Methods, Properties, Event Handling, Integrating JavaScript with various elements of HTML, Cookies, JSON, Applications.	**8**
Module-III	Data Handling, XML , DTD , XML Family of Technologies , Schema , Xquery , Xpath , JSON , AJAX , Database Connectivity	**7**
Module-IV	Single Page and Dynamic Page Applications, JS AJAX, XMLHttp , Applications, jQuery Basics , Effects, jQuery HTML and Traversing , Bootstrap, AngularJS	**8**
Module-V	Server-side programming, PHP, Forms, Sessions, MySQL, Node JS, Modules, NPM, Applications using Node JS with Databases, Overview of React JS, Comparison with Angular JS.	**8**

Learning Resources:

Textbooks:	1. Title- Web Programming- Building Internet Applications, Author- Chris Bates, Publisher- John Wiley & Sons, Edition- 3rd Edition, 2006
Reference Books:	1. Title- Javascript Bible, Author-D. Goodman, M. Morrison, P. Novitski, and C. G. Rayl Publisher- John Wiley & Sons, Edition- 7th Edition, 2010 2. Title- Web Technology: Theory and Practice, Author- Akshi Kumar, Publisher- Chapman and Hall/CRC, Edition- 1st Edition, 2018 3. Title- Web Technologies, Author- Jeffrey C.Jakson, Publisher- Pearson Education, Edition- 1st Edition, 2007
Other Suggested Readings:	

List of Experiments:	
1.	Designing static web pages using HTML
2.	Designing dynamic web pages using different cascading style sheets.
3.	Designing responsive web designs.
4.	Designing XML Schemas.
5.	Programs using JavaScript.
6.	Design event-driven programming, including event handling and form validation.
7.	Programs using Java servlets and JSP.
8.	Designing web applications using PHP.
9.	Designing web applications in the NetBeans environment.
10.	Database Connectivity with MySQL using Java Servlets, JSP, and PHP

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Course Title:	**Digital Logic And Computer Organization**
Course Code:	**CABM 105**
L-T-P:	**3-0-2**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Understand and apply number systems, Boolean algebra, combinational and sequential circuit concepts, and analyze memory types and organization. (L2, L3)	Understand, Applying (Level-II,III)
CO-2	Interpret and utilize the architecture and operation of the ALU, instruction sets, addressing modes, control units, and processor organization. (L2, L3)	Understand, Applying (Level-II, III)
CO-3	Analyze pipelining techniques, identify instruction hazards, and evaluate pipeline design in modern CPUs. (L3, L4)	Applying, Analyzing (Level-III, IV)
CO-4	Evaluate memory organization strategies—including cache and virtual memory—and assess parallel, multi-core, embedded, GPU, and TPU processor architectures. (L4, L5)	Analyzing, Evaluating (Level-IV, V)
CO-5	Explain I/O techniques, including programmed I/O, interrupts, DMA, buses, and interface circuits, focusing on data transfer and device communication. (L1, L2)	Remembering, Understand(Level-I,II)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**1**		**1**		**1**							**1**		**1**
CO-2	**3**	**2**		**1**		**1**							**1**		**2**
CO-3	**3**	**2**		**2**		**1**							**1**		**2**

CO-4	**3**	**2**	**1**	**3**	**1**	**1**						**1**	**1**	**3**
CO-5	**3**	**1**	**1**	**2**		**1**								**1**

1 - Small ext**e**nt **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Number Systems, Binary Arithmetic, Boolean algebra, Map Simplifications, Gates Combinational Circuits, Sequential Circuits, Different Computer & Structure Functional Units, Basic Operational Concepts, Memory: Internal, External, Speed, Size, and Cost.	**9**
Module-II	CPU: Arithmetic and Logic Unit, Instruction Sets, RISC, CISC, Instruction pipeline, Addressing modes and formats, Register organization, Booth's Algorithm, Robertson Multiplication Algorithms. Control Unit Operation, Processor Organization.	**7**
Module-III	Pipelining: Basic Concepts, Instruction Hazards, Data Hazards, Influence on Instruction Sets, Data Path and Control Considerations, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline.	**5**
Module-IV	Memory Organization, Memory Management Requirements, Associative, Cache, Virtual Memory, Performance Considerations. Processors: Parallel, Multi-core, Mobile, Embedded, GPU, and TPU.	**8**
Module-V	External Devices: I/O modules, Programmed I/O, Interrupts, Interrupt Driven I/O, Direct Memory Access, Buses, Interface Circuits, I/O Channels, Asynchronous Data Transfer.	**7**

Learning Resources:

Textbooks:	1. Title-Digital Design, Author- M. Morris Mano, Michael D. Ciletti, Publisher- Pearson Education, Edition- 6th Edition, 2018 2.Title-Computer Organization and Architecture, Author- William Stallings, Publisher-PHI, Edition- 11th Edition, 2019

Reference Books:	1. Title- Computer Organization and Design - The Hardware/Software Interface, Author-D. A. Patterson and J. L. Hennessy, Publisher- Morgan Kaufmann, Edition- 2014 2. Title- Computer System Architecture, Author- M. Morris Mano, Publisher- Prentice Hall of India Pvt Ltd, Edition- Third edition, 2002 3. Title- Computer Organization, Author- C. Hamacher, Z. Vranesic, and S. Zaky, Publisher- McGrawHill, Edition- 2002
Other Suggested Readings:	

List of Experiments:	
1.	To study and verify the truth table of logic gates.
2.	To design code converters.
3.	To realize Half Adder and Full Adder and Half Subtractor and Full Subtractor by using Basic gates and NAND gates.
4.	To design and set up the following circuit using IC 7483. A 4-bit binary parallel adde and A 4-bit binary parallel subtractor.
5.	To design Multiplexers and De-multiplexers.
6.	To design Encoder and Decoder.
7.	To design and set up the following circuit 1) To design and set up a 4:1 Multiplexer (MUX) using only NAND gates. 2) To design and set up a 1:4 Demultiplexer(DE-MUX) using only NAND gates.
8.	Design and implementation of shift registers
9.	To realize a decoder circuit using basic gates and to verify IC 74LS139
10.	To set up and test a 7-segment static display system to display numbers 0 to 9.

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Probability and Statistics**
Course Code:	**CABM 151**
L-T-P:	**3-1-0**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Describe fundamental statistical terms and explain concepts such as probability spaces, distributions, and descriptive statistics (L1,L2).	Remembering, Understand(Level-I,II)
CO-2	Analyze real-world data using statistical distributions and regression techniques to uncover patterns and interpret variability (L4).	Analysing (Level-IV)
CO-3	Evaluate estimation techniques and perform hypothesis testing using appropriate inferential methods (L5).	Evaluating (Level-V)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**		**2**		**1**	**1**								**1**	
CO-2	**2**		**3**			**1**								**2**	**1**
CO-3	**2**		**3**		**1**	**1**								**2**	**1**

1 - Small ext**e**nt **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Probability Spaces, Combinatorial methods (or) Counting techniques, Elementary Theorem,	**5**

	Conditional Probability, Bayes' theorem- Probability Distributions and Probability Densities.	
Module-II	Mathematical Expectation: Expected value, Moments, Chebyshev's theorem, Moment Generating functions, Product Moment, Conditional Expectation, Special Probability Distributions and Probability Densities, Functions of Random Variable. Multiple regression, Linear models, Logistic regression, Rates and Poisson regression, Nonlinear curve fitting, and correlation.	**8**
Module-III	Descriptive Statistics & Sampling Distributions: Population-Sampling-Measures of Central tendency, variations, and position, Sampling distributions: Standard Normal Distribution, Chi-Square Distribution, t-Distribution, F-Distribution, The Central Limit Theorem.	**7**
Module-IV	Estimation: Point Estimation: the method of moments and the method of maximum likelihood estimation, Interval estimation: estimation of mean, estimation of difference of means, estimation of variance, and estimation of ratio of variances.	**8**
Module-V	Test of Hypothesis, Testing for Attributes, Mean of Normal Population, One-tailed and two-tailed tests, F-test and Chi-Square test, Analysis of Variance, Nonparametric test.	**5**

Learning Resources:

Textbooks:	1. Title-Mathematical Statistics with Applications, Author-John.E.Freund, Irwin Miller, Marylees Miller, Publisher- Prentice Hall of India, Edition- 8th edition, 2014 2.Title-Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Author- Michael Mitzenmacher, Eli Upfal, Publisher-Cambridge University PressI, Edition- Second Edition, 2017
Reference Books:	1. Title-Introduction to Probability and Statistics for Engineers and Scientists, Author-Ross, Sheldon. M, Publisher- Academic Press, Edition- 5th Edition, 2014 2. Title- Introduction to Probability and Statistics for Engineers and Scientists, Author-Ross, Sheldon. M, Publisher- Academic Press, Edition- 2009
Other Suggested Readings:	

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Software Engineering**
Course Code:	**CABM 152**
L-T-P:	**3-0-2**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Explain and analyze the phases of the Software Development Life Cycle (SDLC) and their significance in structured software development. (L2, L4)	Understand,Analysing (Level-II,IV)
CO-2	Prepare a comprehensive Software Requirements Specification (SRS) document for a software project based on system requirements and modeling techniques. (L3, L6)	Applying, Creating (Level-III, VI)
CO-3	Apply suitable software design principles, modeling techniques, and development methodologies to create efficient software solutions. (L3, L6)	Applying, Creating (Level-III, VI)
CO-4	Identify and differentiate between various software verification and validation techniques, and assess their applicability in ensuring software quality. (L4, L5)	Analysing, Evaluating (Level-IV, V)
CO-5	Describe the principles of re-engineering and reverse engineering (L2)	Understand (Level-II)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**2**	**1**	**1**		**2**							**3**		**1**
CO-2	**3**	**3**	**2**		**2**	**1**							**3**		

CO-3	**3**	**3**	**3**	**1**		**1**							**3**	**1**	**2**
CO-4	**3**	**3**	**3**	**1**		**1**							**3**	**1**	**2**
CO-5	**3**	**3**	**1**			**1**							**3**	**1**	**2**

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Introduction to Software Engineering: Software Process, Software Process Models, Software Development Life Cycle (SDLC), Requirements, Specification, Design, Implementation, Maintenance, Use-case Modelling, Software Life Cycle, ethics for software engineers.	**8**
Module-II	Software Requirements & SRS Preparation: Techniques for Requirements Gathering, Functional vs Non-functional Requirements, Software Requirements Specification (SRS) Document: Structure and Standards, Data Flow Analysis, Transaction Analysis	**6**
Module-III	Software Design and Development: Design Concepts & Principles, Cohesion and Coupling, Data Encapsulation, Reusability, Module Reuse, Fourth Generation Languages (4GL), Coding Standards	**7**
Module-IV	Verification, Validation & CASE Tools: Module Testing, Software Testing Techniques, White box testing, Basis path testing, CASE Tools for Integration, Complete Software Process, Configuration Management	**7**
Module-V	Project Management and Maintenance: Project Planning and Scheduling, Software Metrics, Cost Estimation (COCOMO Model), Risk Management Activities, Maintenance Models, Software Reuse, Software Reengineering, Reverse Engineering	**8**

Learning Resources:

Textbooks:	1. Title-Software Engineering, Author-Ian Sommerville, Publisher- Pearson Education,Edition- 9th Edition (2010)

Reference Books:	1. Title-Object-Oriented and Classical Software Engineering, Author-Stephen R. Schach, Publisher-Tata McGraw-Hill (TMH), Edition-5th Edition (2010) 2. Title- Fundamentals of Software Engineering, Author- Rajib Mall, Publisher- PHI Learning, Edition- 4th Edition 3. Title- Software Engineering - A Practitioner's Approach, Author- Roger S. Pressman, Publisher-McGraw Hill, Edition- 7th Edition
Other Suggested Readings:	

List of Experiments:	
1.	Study and analyse the phases of the Software Development Life Cycle (SDLC).
2.	Gather requirements and differentiate between functional and non-functional requirements for a sample project.
3.	Prepare a Software Requirements Specification (SRS) document for a given software project
4.	Create use-case diagrams and perform data flow analysis for the sample project
5.	Apply software design principles such as cohesion, coupling, and data encapsulation to design modules.
6.	Develop module reuse and implement coding standards for small software components.
7.	Perform module testing using basic verification and validation techniques (white-box and black-box testing).
8.	Use CASE tools for software integration and configuration management.
9.	Plan and schedule a software project using project management techniques.
10.	Estimate software cost using the COCOMO model and analyze risk management strategies
11.	Study and simulate software maintenance models, reverse engineering, and re-engineering

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Data Structures**
Course Code:	**CABM 153**
L-T-P:	**3-0-2**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Write structured pseudocode to represent algorithmic solutions for given problems. (L1, L2).	Remembering, Understand(Level-I,II)
CO-2	Use linear and nonlinear data structures to model and solve real-time problems (L3, L5).	Applying,Evaluating(Level-III,V)
CO-3	Apply basic searching and sorting techniques in different application domains (L3)	Applying, (Level-III)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**2**			**1**	**1**							**1**		**1**
CO-2	**3**	**3**	**1**	**1**		**1**							**2**	**1**	**1**
CO-3	**3**	**3**	**1**	**1**		**1**							**2**	**1**	**1**

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Introduction: Dynamic aspects of operations on data, Characteristics of data structures, Creation and manipulation of data structures, Operations on data structures, Types of data structures – linear and nonlinear. Introduction to algorithms: Asymptotic notations, Analysis of algorithms: Time and Space complexity.	**5**
Module-II	Arrays: Dynamic memory allocation, one-dimensional arrays, multidimensional arrays, operations on arrays, storage – Row major order, Column major order. Linked lists: types of linked lists – singly, doubly, and circularly linked lists, operations on linked lists.	**7**
Module-III	Stacks: Implementation of stacks– array and linked list, operations on stacks, Applications of Stacks, Notations – infix, prefix, and postfix, Conversion and evaluation of arithmetic expressions using Stacks. Queues: Implementation of queues– array and linked list, operations on queues, Types of queues – queue, double-ended queue, and priority queue.	**8**
Module-IV	Trees: Binary tree, Binary search tree, Threaded binary tree, Height-balanced trees, Tries, Heaps, Hash tables. Graph traversals: Breadth First Search, Depth First Search, Shortest path: Depth first search in directed and undirected graphs. Union-find data structure and applications. Directed acyclic graphs; topological sort.	**8**
Module-V	Searching: Linear search, Binary search, and Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Radix sort, Bucket sort. Algorithm design techniques: Divide and conquer, Greedy approach, and dynamic programming.	**8**

Learning Resources:

Textbooks:	1. Title-Introduction to Algorithms, Author- T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein, Publisher- MIT Press, Edition- 4th Edition, 2022

Reference Books:	1. Title- Data Structures, Author-S. Lipschutz and G.A.V. Pai, Publisher- Tata McGraw-Hill, Edition- 2010 2. Title- Data Structures and Problem Solving using Java, Author- M.A.Weiss, Publisher- Addison Wesley, Edition- 4th edition, 2009 3. Title- Classic Data Structures, Author- D. Samanta, Publisher- PHI, 2nd edition, 2009
Other Suggested Readings:	

List of Experiments:	
1.	Write a Program in C to Implement Stacks Using Arrays and Linked Lists
2.	Write a Program in C to Implement Queues Using Arrays and Linked Lists
3.	Write a program that uses functions to perform the following operations on a singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal
4.	Write a program that uses functions to perform the following operations on a doubly linked list: i) Creation, ii) Insertion, iii) Deletion, iv) Traversal.
5.	Write a program that uses functions to perform the following operations on Circular Linked List i) Creation ii) Insertion iii) Deletion iv) Traversal
6.	Write a program that uses both recursive and non-recursive functions to perform The following searching operations for a Key value in a given list of integers: a) Linear search, b) Binary search
7.	Write a program that implements the following sorting i) Bubble sort, ii) Selection sort, iii)Quick sort.
8.	Write a program that implements the following: i) Insertion sort, ii) Merge sort iii)Heap sort.
9.	Write a program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a Key element in a binary search tree
10.	Write a program to implement the (a) Tree Traversal Methods (b) Graph Traversal Methods

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**Programming using Python**
Course Code:	**CABM 154**
L-T-P:	**1-0-2**
Credits:	**2**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Explain the fundamental concepts of Python programming	Remembering (Level-I)
CO-2	Explain the basic constructs used in Python programming	Remembering (Level-I)
CO-3	Apply control structures such as conditional and looping statements in Python to solve problems	Applying (Level-III)
CO-4	Develop file handling functionalities to manage persistent data and evaluate their effectiveness in Python applications	Creating (Level-VI)
CO-5	Use various utility-based Libraries for Python-based scientific computing	Evaluating (Level- V)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	1			1	1							1		
CO-2	2	3		1	1	1							2		
CO-3	2	1	2			1							1	2	
CO-4	1	2	2	1		1							2	3	1
CO-5	1	1	3		2	1							1	2	

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Introduction to Python Programming Language, Features of Python Programming Language, Flavours of Python Programming Language, Installation of Python Programming Language, Execution of First Python Program.	**5**
Module-II	Data Types, Fundamental Data Types, Collection Data Types – Lists, Tuples, Sets, Frozen sets, Dictionaries, Variables, Operators.	**8**
Module-III	Control Statements, Conditional Statements, Looping Statements, Logical Programs, String Handling tendency, variations, and position, Sampling distributions: Standard Normal Distribution, Chi-Square Distribution, t-Distribution, F-Distribution, The Central Limit Theorem.	**7**
Module-IV	Functions, File handling, Object Oriented Programming in Python, Exception Handling in Python, Class and Objects.	**8**
Module-V	Different modules and packages for scientific computing in Python (Numpy, Pandas, Matplotlib, Scipy, Sympy, etc.), Database access, Regular Expressions.	**8**

Learning Resources:

Textbooks:	1. Title-Think Python: How to Think Like a Computer Scientist Author: Allen B. Downey, Publisher: Shroff/O,,Reilly Publishers 2nd edition, 2016
Reference Books:	1. Title-An Introduction to Python Author: Guido van Rossum and Fred L. Drake J, Publisher: Network Theory Ltd. Revised and updated for Python 3.2, 2011 2. Title- Introduction to Computation and Programming Using Python Author: John V Guttag, Publisher: MIT Press Revised and expanded Edition, 2013 3. Title- Exploring Python‖ Author: Timothy A. Budd, Publisher: Mc-Graw Hill Education (India) private Ltd. 2015
Other Suggested Readings:	

Lab Experiments:

Exp. No.	List of Experiments
1.	Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program.
2.	Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment.
3.	Understanding Data Type, Data Type Conversion, Python Input and Output Functions, and Import command.
4.	Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.
5.	Decision-making statements, Python loops, Python control statements.
6.	Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings.
7.	Built-in Functions, User-defined functions, Anonymous functions, Pass by value, Pass by Reference, Recursion
8.	Exceptions, Built-in exceptions, Exception handling, User-defined exceptions in Python.
9.	Python OOP Concepts, Object Class, Constructors, Inheritance
10.	Numpy data types, Operations on Numpy Array (indexing, slicing, shape/reshape, iteration, join, split, search, sort, filter)

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Scheme of Master of Computer Application to be applicable from 2025-2026 onwards

Course Title:	**System Programming**
Course Code:	**CALM 155**
L-T-P:	**3-1-0**
Credits:	**4**
Pre-requisites:	**NIL**

Course Outcomes:

Course Outcomes		**Cognitive Levels**
CO-1	Apply the knowledge of assembly and macro processors to translate assembly language into machine code	Analysing (Level-IV)
CO-2	Analyse the working phases of the Compiler to undertake meaningful language translation	Analysing (Level-IV)
CO-3	Evaluate functionalities of Linkers, Loaders, interpreters, and debugging methods to manage system memory and provide a portable runtime environment	Evaluating (Level-V)
CO-4	Analyze the working of an operating system and its component	Analysing (Level-IV)

Course Articulation Matrix:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**2**		**1**		**1**							**2**		**1**
CO-2	**2**	**3**		**1**		**1**							**2**		**1**
CO-3	**2**	**2**		**3**	**1**	**1**							**2**		**2**
CO-4	**2**	**1**		**3**		**1**							**1**		**3**

1 - Small extent **2 -** Significantly **3 -** Strongly

Syllabus:		
Module	**Detailed Syllabus**	**Contact Hours**
Module-I	Introduction: Evolution of the Components of a Programming System, Evolution of Operating Systems. Machine Structure, Machine Language, and Assembly Language.	**5**
Module-II	Assemblers: Design of Assemblers. Table Processing: searching and sorting. Macro Language and the Macro Processor: Macro Instructions, Features of Macro facility, Implementation.	**7**
Module-III	Loaders: Loader Schemes, Design of an Absolute Loader, Design of a Direct-Linking Loader	**8**
Module-IV	Compilers: Statement of problem, Phases of the compiler, Data Structures, Recursion, Call and Return statements, Storage Classes – Use, Implementation, Block Structure, Nonlocal Go To's, Interrupts, Pointers.	**8**
Module-V	Operating Systems: I/O Programming, Memory Management, Processor Management, Device Management, Information Management.	**8**

Learning Resources:

Textbooks:	1. Title: Systems Programming Author: John J. Donovan, Publisher: Tata McGraw-Hill 2014
Reference Books:	1. Title-System Software- An Introduction to Systems Programming Author: L.L. Beck, Publisher: Addition Wesley 3rd Edition, 1996.
Other Suggested Readings:	