Puducherry Technological University Puducherry – 605014

(A Technological University of Government of Puducherry)

Curriculum and Syllabi

for

M.C.A. (Computer Applications)

(Effective from the Academic Year 2020 – 21)

(Submitted for Approval in the Sixth Academic Council Meeting)

CURRICULUM

The curriculum of M.C.A. is designed to fulfill the Programme Educational Objectives (PEO), Programme Outcomes (PO) and Programme Specific Outcomes (POS) listed below:

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1	Produce knowledgeable and skilled human resources which are employable in IT and ITES.
PEO2	Impart knowledge required for planning, designing and building Application Software Systems as well as provide support to automated systems or applications.
PEO3	Demonstrate analytical and design skills including the ability to generate creative solutions and foster team-oriented professionalism through effective communication.
PEO4	Exhibit effective work ethics and be able to adapt to the challenges of a dynamic job environment.
PEO5	Inculcate Entrepreneurial skills among students who can develop customized solutions for small to large Enterprises.

PROGRAMME OUTCOMES (PO)

PO1	Ability to understand and apply knowledge of computing, mathematics and science in solving problems.
PO2	An ability to design, implement and evaluate a computer-based system, process, component, or program to meet stakeholder needs.
PO3	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.
PO4	Function effectively both as a member and leader in a team on multi-disciplinary projects to demonstrate computing and managerial skills, and Communicate effectively and present technical information in oral and written reports.
PO5	Involve in persistent learning for continuous professional development and progress as an efficient computer professional.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1	Create proficiency to demonstrate design and develop modern software applications
PSO2	Conceptualize real-time problems and to provide ease of use mobile applications and web services

Distribution of Credits among the subjects grouped under various categories:

Courses are grouped under various categories and the credits to be earned in each category of courses are as follows:

Sl. No.	Category	Credits	Course Category Code (CCC)
1	Programme Core Course	47	PCC
2	Programme Specific Elective Courses	15	PSE
3	Professional Activity Courses (Project Work, Comprehensive viva voce)	14	PAC
4	Bridge Courses *	Non – Credit	BRC*
	Total	**76**	

(*Compulsory for students who are admitted with Bachelor degree in specialization other than Computer Science and Computer Applications)

Semester Wise Courses and Credits

Semester I

Course Code	Course	CCC	Periods			Credits
			L	T	P	
MA253	Mathematics for Computer Science	PCC	4	0	0	4
CA201	Data Structures and Algorithms	PCC	3	0	0	3
CA202	Object Oriented Programming	PCC	3	0	0	3
CA203	Computer Organization and Architecture	PCC	3	0	0	3
CA204	Software Engineering	PCC	3	0	0	3
CA205	Data Structures and Algorithms Laboratory	PCC	0	0	4	2
CA206	Object Oriented Programming Laboratory	PCC	0	0	4	2
Total			**24**			**20**

Bridge Courses (BRC)* – One Week Only

Course Code	Course	CCC	Periods			Credits
			L	T	P	
BD201	Introduction to IT and Problem Solving Techniques	BRC	14	0	0	0
BD202	Principles of Digital Computer System	BRC	14	0	0	0
BD203	Fundamentals of C Programming	BRC	14	0	0	0
Total			**42**			0

* Candidates without Computer Science background need to attend these mandatory courses **Semester II**

Course Code	Course	CCC	Periods			Credits
			L	T	P	
CA207	Database Management Systems	PCC	3	0	0	3
CA208	Computer Networks	PCC	3	0	0	3
CA209	Operating Systems	PCC	3	0	0	3
CAZXX	Programme Specific Elective –1	PSE	3	0	0	3
CAZXX	Programme Specific Elective –2	PSE	3	0	0	3
HS203	Communication Skills	PCC	2	0	2	3

CA210	Database Management Systems Laboratory	PCC	0	0	4	2
CA211	Operating Systems and Computer Networks Laboratory	PCC	0	0	4	2
Total			**27**			**22**

Semester III

Course Code	Course	CCC	Periods			Credits
			L	T	P	
CA212	Internet and Web Programming	PCC	3	0	0	3
CA213	Mobile Application Development	PCC	3	0	0	3
CAZXX	Programme Specific Elective – 3	PSE	3	0	0	3
CAZXX	Programme Specific Elective – 4	PSE	3	0	0	3
CAZXX	Programme Specific Elective – 5	PSE	3	0	0	3
CA214	Web Programming Laboratory	PCC	0	0	4	2
CA215	Mobile Application Development Laboratory	PCC	0	0	4	2
CA216	Mini Project	PCC	0	0	2	1
Total			**25**			**20**

Semester IV

Course Code	Course	CCC	Periods			Credits
			L	T	P	
CA217	Comprehensive Viva Voce	PAC	0	0	0	2
CA218	Project Work & Dissertation	PAC	0	0	0	12
Total			**30**			**14**

Programme Specific Electives (PSE)

PSE – 1	**CAZ01**	Advanced Java Programming
	CAZ02	Python Programming
	CAZ03	Embedded Systems
	CAZ04	Graphics and Image Processing
PSE -2	**CAZ05**	Artificial Intelligence
	CAZ06	Automata Theory and Computation
	CAZ07	Data Science and Analytics

	CAZ08	Multimedia Systems and Tools
PSE -3	**CAZ09**	Platform Technology
	CAZ10	Object Oriented Software Engineering
	CAZ11	Software Project Management and Quality Assurance
	CAZ12	User Interface Design
PSE – 4	**CAZ13**	Machine Learning
	CAZ14	Internet of Things
	CAZ15	Data Mining and Business Intelligence
	CAZ16	Digital Marketing
PSE – 5	**CAZ17**	Information Security
	CAZ18	Ethical Hacking
	CAZ19	Blockchain Technology
	CAZ20	Cloud Computing

XX – Department Code; NN – Running Number; N – Running Number Department : **Mathematics**
Programme: **M. C. A.**

Semester : **First** Course Category Code: **PCC** Semester Exam Type: **TY**

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
MA211	**Mathematics for Computer Science**	4	-	-	4	40	60	100

Prerequisite -

Course Outcomes

CO1	Develop knowledge of logical connectivity, compound propositions, Creating formal symbols of propositional logic and find exact value of expressions.	
CO2	Explain the formal symbols to predicate logic	Understanding
CO3	Knowledge of Inference theory of the predicate calculus	Remembering
CO4	Construct sample spaces of random experiments and identify the distributions.	Creating
CO5	List Stochastic processes and solve Queuing theory problems	Remembering

UNIT-I Mathematical Logic **Periods: 12**

Connectives, Statement formulae, well-formed formulae -Tautologies. Equivalence of statement formulae, Duality law-Tautological implications- Functionally complete set of connectives -AND and NOR **CO1** connectives.

UNIT-II Normal Forms and Inference Theory **Periods: 12**

Principal conjunctive and disjunctive normal forms Inference calculus-validity of conclusion using truth table-Rules of inference -Derivation process-Conditional proof-Indirect method of proof- Derivation of **CO2** validity of conclusion by these methods.

UNIT-III	**Predicate Calculus**	**Periods: 12**

Predicate calculus: Predicates, the statement function, variables and quantifiers-Predicate formulassymbolizing the statement. Inference theory of the predicate calculus-Rules of specification and **CO3** generalization-Derivation of conclusion using the rules of inference theory.

UNIT-IV	**Discrete and Continuous Distributions**	**Periods: 12**

Random Variables and their event spaces - Probability mass function, Distribution functions, and Special discrete distributions: Bernoulli, Binomial, Poisson, Geometric, Hyper geometric, Negative Binomial - Characteristic function - Some important Continuous distributions: Exponential, Hypo exponential, **CO4** Erlang, Gamma, Hyper exponential, Weibull, Gaussian and Pareto distributions.

UNIT-V	**Stochastic Processes and Poisson Queuing Models**	**Periods: 12**

Stochastic Processes: Definition, Classification of Stochastic Processes - Bernoulli Process, Poisson process, Markov Process, Markov Chain. The Birth and Death process: M/M/1, M/M/c, M/M/1/N, **CO5** M/M/c/N (c < N), M/M/c/c, M/M/∞ models only - derivation of mean number of customer in the system, queue and waiting time - Simple applications.

Lecture Periods: 60 Tutorial Periods: - Practical Periods: - Total Periods: 60 Reference Books

1. J.PTremblay and R.Manohar, Discrete Mathematical Structures with Applications to Computer science, Tata McGraw-Hill Publishing company pvt. Ltd., New Delhi, 2002.
2. Kishore S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, John Wiley & Sons Inc. Second Edition, 2012.
3. D.Gross and C.M.Harris, Fundamentals of Queuing Theory, Wiley Students Edition, Third Edition, 2012.
4. J.Medhi, Stochastic models in Queuing Theory, Academic Press, Second Edition, 2012.
5. J. Medhi, Stochastic Processes, New Age International (P) Ltd., Second Edition, 2012.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3					2	1
CO2	3	2				1	
CO3	2		3			2	1
CO4	-	2	3			1	1
CO5	2	2				1	1
Avg	2	1.2	1.2			1.4	0.8

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA201	**Data Structures and Algorithms**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcomes	**CO1**	Explain the basic algorithmic notations, linear and non linear data structures and searching & sorting techniques							Understanding
	CO2	Illustrate algorithms using linear and nonlinear data structures for new real time problems							Understanding
	CO3	Demonstrate the various algorithmic techniques							Understanding
	CO4	Compare the operations of various algorithmic techniques for a specific problem							Analysing
	CO5	Build new solutions using the various algorithmic techniques							Creating

UNIT I	**Introduction**	**Periods**: **9**
Algorithm: Definition – specification – Recursive functions. Performance analysis: Time and Space complexity, Asymptotic Notations (O, Ω, Θ). Data structures Definition. Arrays: 1-Dimensional, 2-Dimensional and n-Dimensional arrays - representation - array operations. Searching: Linea search, binary search. Sorting: Bubble sot, selection sort, insertion sort, radix sort.		**CO1 CO2 CO3**
UNIT II	**Linked List, Stacks and Queues**	**Periods**: **9**
Linked Lists: Singly, doubly linked lists and Circular Linked Lists, Applications of linked list. Stack: Definition, operations and applications of stack. Linked List Representations and implementation of stack. Queues: Definition, operations. Array and Linked List implementations of Queues. Priority Queue and De queue, Applications of Queue. Dynamic storage management.		**CO2 CO3**
UNIT III	**Tree, Graph, Hashing**	**Periods**: **9**
Tree: Definition and related terms – binary tree: representation – traversals of binary tree – conversion of general tree to binary tree – applications of tree. Binary search tree. Graph: Definition, representation, traversals, Single-source-shortest path - applications. Spanning tree, Minimum cost spanning Trees. Hash tables and Hashing Techniques		**CO2 CO3**
UNIT IV	**Divide-and-Conquer, Greedy**	**Periods**: **9**
Divide and Conquer: General method, Binary Search, Max. And Min. problem; Merge sort; Quick sort. Greedy Method: General Method, Optimal Storage on Tapes, Knapsack Problem, Job Sequencing with Deadlines; Optimal Merge Pattern; Single Source Shortlist Paths problem.		**CO3 CO4 CO5**
UNIT V	**Dynamic Programming and Backtracking**	**Periods: 9**

Dynamic Programming: General method, Multistage Graphs; All Pair Shortest Paths; Travelling Salesman Problem. Backtracking Strategy: General method, 8-Queens Problem, Sum of Subsets, Graph Coloring, and Knapsack Problem.	**CO3** **CO4** **CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2006.
2. G A V Pai, Data Structures and Algorithms - Concepts, Techniques and Applications, Tata McGraw-Hill, 2010.
3. Ellis Horowitz, Sartaj Sahni and Anderson Freed, Fundamentals of Data Structures in C, Silicon Press, 2008.
4. Debasis Samanta, Classic Data Structures, Second Edition, PHI Learning Pvt. Ltd, 2013.
5. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms, Silicon Press, 2008.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Avg	3	3	3	3	3	3	3

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA202	**Object Oriented Programming**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Adapt C++ Programming concepts to construct application					Creating		
	CO2	Experiment various object-oriented features using C++					Applying		
	CO3	Understand and apply the features of java					Applying		
	CO4	Design application software using controls and Swing					Creating		
	CO5	Create model using concepts of java programming					Creating		

UNIT I	**Introduction to C++ Programming Language**	**Periods: 9**
Limitations in structured programming - Characteristics of Object-Oriented Language - Data types - Loops Functions - Classes Objects - Constructors and Destructors - Operator Overloading and Type Conversion.		**CO1**
UNIT II	**Object Oriented Features of C++**	**Periods: 9**
Inheritance – Types of Inheritance – Virtual base classes – abstract classes. Pointer to class and object – pointer to derived classes and base classes, Polymorphism and Virtual Functions – Templates - Exception Handling.		**CO2**
UNIT III	**Java Basics**	**Periods: 9**
Java features –Java Platform –Java Fundamentals –Data Types – Variables and Arrays - Expressions, Operators, and Control Structures – Classes and Objects -Methods - Constructors – Destructors Inheritance – Types Packages, Polymorphism- Abstract classes - Overloading.		**CO3 CO4**
UNIT IV	**GUI and Swing**	**Periods: 9**
Final declaration - Packages -Interfaces and Inner Class - Java I/O System - Run time type identification – User Interface design basics with swing.		**CO4**
UNIT V	**Java Network and Applets Programming**	**Periods: 9**
Network programming - Applets class - Architecture - Applet Programs - Abstract window tool kit.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Bjarne Stroustrup, The C++ Programming Language, Third Special Edition, Addison Wesley, 2000.
2. Bruce Eckel, Thinking in Java, Third Edition, Prentice Hall PTR, 2002.
3. E.Balaguruswamy, Object Oriented Programming with C++, Tata McGraw Hill Publications Ltd, 4th Edition, 2008.
4. Deitel and Deitel, C++ How to program, Ninth Edition, Prentice Hall, 2014.
5. Deitel and Deitel, JAVA How to Program, Eleventh Edition, Prentice Hall, 2017.
6. Herbert Schildt, Java SE 6: The Complete Reference, Eleventh Edition, McGraw-Hill, 2018.
7. Cay S. Horstmann, Core Java: Volume II-Advanced Features, Eleventh Edition, Prentice Hall, 2019.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2				2	2
CO2	2						
CO3	2	3				2	2
CO4	2	2				2	2
CO5	1	2					
Avg	1.8	1.8				1.2	1.2

Score : **3**-High; **2**-Medium; **1**-Low

<table>
<tr><td colspan="3">Department: Computer Science and Engineering</td><td colspan="5">Programme: M.C.A.</td></tr>
<tr><td colspan="3">Semester: First</td><td colspan="3">Course Category Code: PCC</td><td colspan="2">Semester Exam Type: TY</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Periods / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td></td><td>CA</td><td>SE</td><td>TM</td></tr>
<tr><td>CA203</td><td>Computer Organization and Architecture</td><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td>Prerequisite</td><td colspan="8">-</td></tr>
<tr><td rowspan="4">Course Outcomes</td><td>CO1</td><td colspan="5">Compare typical computer instruction execution on a basic processor and pipelined architectures</td><td colspan="2">Understanding</td></tr>
<tr><td>CO2</td><td colspan="5">Apply computer arithmetic techniques for design and development of cost effective applications</td><td colspan="2">Applying</td></tr>
<tr><td>CO3</td><td colspan="5">Identify and compare different methods for computer I/O</td><td colspan="2">Applyinng</td></tr>
<tr><td>CO4</td><td colspan="5">Assess the computer performance based on the processor architecture, instruction set and memory hierarchy</td><td colspan="2">Evaluating</td></tr>
<tr><td>UNIT I</td><td colspan="5">Register Transfer and Microoperations</td><td colspan="2">Periods : 9</td></tr>
<tr><td colspan="7">Register Transfer language - Register Transfer - Bus and Memory Transfers- Arithmetic Microoperations Logic Microoperations - Shift Microoperations - Arithmetic Logic Shift Unit</td><td>CO1</td></tr>
<tr><td>UNIT II</td><td colspan="5">Basic Computer Organization and Design</td><td colspan="2">Periods : 9</td></tr>
<tr><td colspan="7">Instruction Codes – Computer Registers – Computer Instructions – Computer Instructions – Timing and Control – Instruction Cycle – Memory reference Instructions - Input – Output and Interrupt Design of Basic Computer – Design of Accumulator logic.</td><td>CO1
CO4</td></tr>
<tr><td>UNIT III</td><td colspan="5">Micro-programmed Control and Processor Organization</td><td colspan="2">Periods : 9</td></tr>
</table>

Memory Organization - Memory hierarchy – main memory – auxiliary memory –Associate memory – Cache memory. Control Memory-Address sequencing- Micro program Example – Design of control unit. Processor Organization: general register organization – stack organization – instruction formats – addressing modes – data transfer and manipulation – program control.			**CO4**
UNIT IV	**Data Representation and Computer Arithmetic**	**Periods : 9**	
Data Representation - Data Types – Complements - Fixed-Point Representation - Floating-Point Representation - Error Detection Codes. Computer Arithmetic: Addition, Subtraction, Multiplication, Division algorithms- Floating point arithmetic operations- Decimal arithmetic operations			**CO2** **CO4**
UNIT V	**Input-Output Organization and Parallel Processing**	**Periods : 9**	
Input-output interface – asynchronous data transfer - modes of transfer – priority interrupt – Direct Memory Access – Input-Output Processor – Serial communication. Parallel Processing – Pipelining - Arithmetic Pipeline.			**CO1** **CO3**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. M. Morris Mano, Computer System Architecture, Third edition, Pearson, 2019.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
3. William Stallings, Computer Organization and Architecture, Designing for Performance, Tenth Edition, Pearson Education, 2016.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2			2		
CO2	2	2			2		
CO3	1	1			2		
CO4	2	2	1		2		
Avg	1.75	1.75	1		2		

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA204	**Software Engineering**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcomes	**CO1**	Interpret the fundamental concepts of software engineering and various lifecycle models for effective software development.					Understanding		
	CO2	Evaluate the software project management activities for requirement analysis.					Evaluating		
	CO3	Develop the architectural design for real time systems					Creating		
	CO4	Apply object-oriented concepts for building large scale complex system.					Applying		
	CO5	Summarize the various user interface design and testing strategies for ensuring quality software development.					Understanding		

UNIT I	**Introduction to Software Engineering**	**Periods** : **9**
The Software Engineering Discipline – Evolution and Impact – Software Development projects – Emergence of Software Engineering – Computer System Engineering – Software Life Cycle Models – classic Waterfall model – Iterative Lifecycle model – prototyping model – Evolutionary model – spiral model – Comparison of Life cycle models.		**CO1**

UNIT II	**Software Project Management and Requirements Analysis**	**Periods** : **9**
Responsibilities of a Software Project Manager – Project Planning – Metrics for Project Size Estimation – Empirical Estimation Techniques – COCOMO – Halstead's Software Science – Staffing Level Estimation – Scheduling – Organization and Team structures – Staffing – Risk Management – Software Configuration Management – Requirements Gathering and Analysis – Software Requirements specification – Formal System Specification – Axiomatic Specification - Algebraic Specification – 4GL		**CO2**

UNIT III	**Software Design and Function Oriented Software Design**	**Periods** : **9**
Outcome of a Design Process – Characteristics of a Good Software Design – Coupling and Cohesion – Approaches to Software Design – Object Oriented Vs Function Oriented Software Design approaches – Structured Analysis – Data Flow Diagrams – Applying DFD to Real time systems – Structured and Detailed Design.		**CO3**

UNIT IV	**Object Modeling and Object Oriented Software development**	**Periods** : **9**
Overview of OO concepts – UML – Use case model – Class diagrams – Interaction diagrams – Activity diagrams – state chart diagrams - Patterns – Types – Object Oriented Analysis and Design methodology – Interaction Modelling – OOD Goodness criteria.		**CO4**

UNIT V	User Interface Design and Testing	Periods : 9
Characteristics of a good User Interface – Types – Fundamentals of Component based GUI Development – A User Interface Design methodology – Coding – Software Documentation – Testing – Unit Testing – Black Box testing – White Box testing – Debugging – Program Analysis tools – Integration testing – Testing Object Oriented programs – System Testing – Issues.		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Reference Books

1. Rajib Mall, Fundamentals of Software Engineering, PHI Learning, Fifth Edition, 2018.
2. Roger Pressman, Software Engineering A Practitioner's Approach, Eight edition, McGraw-Hill, 2019.
3. Ian Sommerville, Software Engineering, Pearson Education, Tenth edition, 2016.
4. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa, Third edition, 2008.
5. L. Pfleeger and J.M. Atlee, Software Engineering Theory and Practice, Pearson Education, Third edition, 2008

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2	0	1	1	3	2
CO2	2	3	0	1	1	1	3
CO3	2	3	0	1	1		3
CO4	3	2	0	1	1	2	2
CO5	2	2	0	1	1	2	2
Avg	2.2	2.4	0	1	1	1.6	2.4

Score: **3** – High; **2** – Medium; **1** – Low

Department: **Computer Science and Engineering**		Programme: **M.C.A.**						
Semester**: First**		Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CA205	**Data Structures and Algorithms Laboratory**	-	-	4	2	40	60	100
Prerequisite	-							

Course Outcome	**CO1**	Develop programs using linear and non linear data structures	Applying
	CO2	Build new algorithms using linear and non linear data structures	Creating
	CO3	Experiment with various searching and sorting techniques in real time problems	Applying
	CO4	Solve problems using appropriate algorithmic techniques viz., Divide and Conquer, Greedy algorithm, Dynamic programming and Backtracking	Applying
	CO5	Analyse every algorithm for a given problem by comparing with related algorithms	Analyzing

List of Experiments : Implementation of the experiments using C

1. Singly Linked List 2. Doubly Linked List 3. Circular Linked List 4. Stack and Queue using array and pointer	**CO1** **CO2**
5. Binary tree traversals using pointer. 6. Graph Traversals: BFS and DFS. Dijkstra Algorithm using array/pointer	**CO1** **CO2** **CO5**
7. Merge sort, Quick sort, Binary search using Divide-and-Conquer technique. 8. Knapsack problem, Kruskal's and Prim's Algorithms using Greedy technique.	**CO3** **CO4** **CO5**
9. Multi-stage Graph, Travelling Salesman Problem using dynamic programming. 10. 8-Queens Problem using backtracking 11. Graph Coloring using backtracking	**CO4** **CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods:60**

Reference Books

1. G A V Pai, Data Structures and Algorithms - Concepts, Techniques and Applications, Tata McGraw-Hill, 2010.
2. Ellis Horowitz, Sartaj Sahni and Anderson Freed, Fundamentals of Data Structures in C, Silicon Press, 2008.
3. Debasis Samanta, Classic Data Structures, Second Edition, PHI Learning Pvt. Ltd, 2013.
4. Ellis Horowitz, Sataj Sahni and Sanguthevar Rajasekaran, Computer Algoithms, Silicon Press, 2008.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	3	2	2	2	2
CO2	3	3	3	2	2	2	2
CO3	3	3	3	2	2	2	2
C04	3	3	3	2	2	2	2
CO5	3	3	3	2	2	2	2
Avg	3	3	3	2	2	2	2

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA206	**Object Oriented Programming Laboratory**		-	-	4	2	40	60	100
Prerequisite									
Course Outcome	**CO1**	Experiment C++ Programming concepts to construct application					Applying		
	CO2	Develop C++ application with Object Oriented features					Applying		
	CO3	Experiment basics of java programming language.					Applying		
	CO4	Design and implement application using controls and database					Applying		
	CO5	Experiment latest concepts of java programming model					Applying		

List of Experiments :

Programming Using C++ 1. Program to implement classes and objects. 2. Program to implement constructors and destructors with array of objects. 3. Program to demonstrate function overloading. 4. Program to implement strings and Exception handling 5. Program to implement different types of inheritances like multiple, Multilevel and hybrid. 6. Programs to implement virtual functions to demonstrate the use of run time polymorphism 7. Program to implement class and function templates.	**CO1** **CO2**
Programming Using Java 1. Study of execution of simple Java programs. 2. Programs to implement classes and objects in java. 3. Programs to implement constructors and destructors in Java 4. Programs to demonstrate wrapper classes, inheritance in Java.	**CO3**
Programming Using Java 5. Program to demonstrate exception handling technique. 6. Program to design and implement swing concepts. 7. Program to design interfaces. 8. Program to design an event handling event for simulating a simple calculator.	**CO4,** **CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods:60**

Reference Books

1. Bjarne Stroustrup, The C++ Programming Language, Third Special Edition, Addison Wesley, 2000.
2. Bruce Eckel, Thinking in Java, Third Edition, Prentice Hall PTR, 2002.
3. E.Balaguruswamy, Object Oriented Programming with C++, Tata McGraw Hill Publications Ltd, 4th Edition, 2008.
4. Deitel and Deitel, C++ How to program, Ninth Edition, Prentice Hall, 2014.
5. Deitel and Deitel, JAVA How to Program, Eleventh Edition, Prentice Hall, 2017.
6. Herbert Schildt, Java SE 6: The Complete Reference, Eleventh Edition, McGraw-Hill, 2018.
7. Cay S. Horstmann, Core Java: Volume II-Advanced Features, Eleventh Edition, Prentice Hall, 2019.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2					1	
CO2		2				2	
CO3	2	1					
C04		2				2	
CO5		2				1	
Avg	0.4	1.4				1.2	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			Course Category Code: **BRC**			Semester Exam Type: -			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
BD201	**Introduction to IT and Problem-Solving Techniques**		-	-	-	0	-	-	-
Prerequisite									
Course Outcomes	**CO1**	Develop a foundational knowledge of IT concepts and terminology					Applying		
	CO2	List the basic concepts of Internet, data transmission and Applications					Remembering		
	CO3	Analyze a problem and devise an algorithm for the problem					Analysing		
	CO4	Illustrate problem-solving skills and creative ideation skills for a real-life					Understanding		

Lecture-1	**Information Technology Basics**	**Periods : 1**
Introduction, Need for Information Storage and Processing, Information Technology Components, Role of Information Technology, Information Technology and the Internet		**CO1 CO2**
Lecture-2	**Internet and its Tools**	**Periods : 2**
Internet Evolution, Basic Internet Terminology, Data over Internet, Modes of Data Transmission, Types of Networks, Getting Connected to Internet Applications, Internet Applications, Computer Ethics. Introduction. Electronic Commerce (E-Commerce),		**CO2**
Lecture-3	**Problem solving with Computer Programming**	**Periods : 3**
Introduction, Properties of an Algorithm, Description of Algorithms, *flowchart,* Pseudo Code, Analysis of Algorithms		**CO3 CO4**
Lecture-4	**Concepts of Programming Language**	**Periods : 3**
Computer Programming Language: Low level languages, High level languages. Computer Programming Paradigms: Procedural programming, Structured programming, Object-oriented programming, Programming Languages for Scientific and Business Computing		**CO3, CO4**

Lecture Periods: 9	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 9**

Reference Books

1. E.Balagurusamy, Computing fundamentals and C Programming, Tata McGraw-Hill Publishing Company Limited, First Edition, 2008.
2. Behrouz A. Forouzan and Richard F. Gilberg, A Structured Programming Approach Using C, Second Edition, Brooks - Cole Thomson Learning Publications, 2007.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	1	1					

CO2	2						
CO3	2						
CO4	3	3			1	2	2
AVG	2	1			0.25	0.5	0.5

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**					
Semester: **First**			Course Category Code: **BRC**			Semester Exam Type**: -**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
BD202	**Principles of Digital Computer System**	-	-	-	0	-	-	-
Prerequisite								

Course Outcome	**CO1**	Understand the binary number systems and logic gates	Understanding
	CO2	Recall about Boolean algebra and solve problems on simplification methods	Remembering
	CO3	Design any combinational logic using only of universal gates, MSI gates and PLDs	Applying
	CO4	Design and implement sequential logic circuits	Applying
	CO5	Identify the properties of RAM,ROM,PROM,EPROM,EEPROM memory units	Applying

Lecture-1	**Introduction to Logic Gates**	**Periods : 1**
Introduction to Digital Computer - Logic Gates		**CO1**
Lecture-2		**Periods : 2**
Boolean algebra - Map simplification - Half-adder and full-adder		**CO2**
Lecture-3		**Periods : 3**
Integrated circuits - Decoders and Encoders - Multiplexers		**CO3, CO4**
Lecture-4		**Periods : 3**
Introduction to Flip Flops - Registers - RAM and ROM memories - Types of ROM memory		**CO5**

Lecture Periods: 9	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 9**

Reference Books

1. M. Morris R. Mano, Charles R. and Tom Martin, Logic and Computer Design Fundamentals, 5th Edition, Pearson, 2016.
2. T homas L. Floyd , Digital Fundamentals, Eleventh Edition, Pearson, 2014.
3. Donald P. Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and Applications, 8th Edition, McGraw Hill, 2014.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2						
CO2	2						
CO3		2					
CO4		2					
CO5	2						
Avg	1.2	0.8					

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **First**			**Course Category Code: BRC**			Semester Exam Type: -			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
BD203	**Fundamentals of C Programming**		-	-	-	0	-	-	-
Prerequisite									
Course Outcome	**CO1**	Acquired Knowledge about the fundamental programming aspects and use of a Programming Language					Remembering		
	CO2	Recognize and define data types for simple data processing application					Applying		
	CO3	Test the programs for syntax and logical error					Analysing		
	CO4	Demonstrate the ability to work with arrays of complex objects.					Understanding		
	CO5	Create code to provide a solution to problem statements ranging from simple to complex.					Creating		
Lecture-1	**Introduction to C programming Language**					**Periods : 1**			
Overview of programming Languages. Need for Computer Languages. Introduction to Flowchart. - Basic structure of C program, Character set, Tokens, Keywords and Identifiers in C, Variables and Data Types, Constants, Global and Local Variable. Console IO Operations, printf and scanf.									**CO1 CO2**
Lecture-2	**Operators, Expressions and Control statements**					**Periods : 2**			

Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence. Decision Making Statements - If, Ifelse , Switch, Nested loops. Loop Control statements: While, Do-while, For statements,. Control Flow statement: Break, Continue and goto statements, Comma operator	**CO2 CO3 CO5**

Lecture-3	**Arrays , strings , Structures And Union**	**Periods : 3**

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array 2 hours 3.2 String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets). Introduction to Structure. Array of Structure. Nested Structure. Introduction to Union	**CO3, CO4 CO5**

Lecture-4	**Functions and Pointers**	**Periods : 3**

Function Calling in C, Return type in Function, Call by Value, User Define Function, and Predefined Functions. Introduction to pointers, Call by reference in Function. Introduction to preprocessor.	**CO5**

Lecture Periods: 9	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 9**

Reference Books

1. Balagurusamy. E, Programming in ANSI C, Tata McGraw Hill, Seventh Edition, 2017.
2. Byron Gottfried & Jitender Chhabra, Programming with C, Schaum's Outlines Series, 2017.
3. Brian W. Kernighan & Dennis Ritchie. The C Programming Language, Pearson Education India; 2nd Edition, 2015.
4. Ashok N Kamthane, Computer Programming, Pearson education, Second Edition, 2012.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	1					
CO2	3	1					
CO3	2	2				1	
CO4	3	2				2	
CO5	3	3	2			3	1
AVG	2.8	1.8	0.4			1.2	0.2

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**		Programme: **M.C.A.**						
Semester: **Second**		Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CA207	**Database Management Systems**	3	-	-	3	40	60	100
Prerequisite	-							

Course Outcome	**CO1**	Design a database system using ER and relational data model for a specific application domain	Creating
	CO2	Solve queries to perform transactions using SQL,PL/SQL related to a specific application by applying normalization theory	Applying
	CO3	Examine concurrency control protocols for transaction processing	Analysing
	CO4	Appraise Advanced database concepts, query optimization, hashing/indexing techniques for efficient Information retrieval	Evaluating

UNIT I	**Database Concepts and Data Model**	**Periods**: **9**	
Database System: Definition, Purpose, Application, Data Abstraction, Database Architecture, Database Users, Database Administrators, Instances & Schema, Data Models *Entity Relationship Model:* Overview, Definitions, ER diagram, Mapping Cardinalities, Reduction to Relational Schema, Extended ER Features. *Relational Model:* Structure of Relational Database, Keys (Primary, Foreign, Candidate, Super). *Relational Query Languages*: Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.			**CO1**
UNIT II	**Database Design and Querying**	**Periods**: **9**	
Relational Database Design: Overview, Features, Normalization, Normal Forms (First, Second, Third, Boyce Codd), Decomposition using Functional Dependencies and Multi-Valued Dependencies. *SQL :* Definition, Basic Structure, Datatypes, Basic Operations (DDL, DML, DCL), Set Operations, Aggregate Functions, Nested Subqueries, Join Expression, Views, Transactions, Integrity Constraints, Authorization. PL-SQL: Definition, Basic Structure, Procedures, Functions, Cursors, Triggers, Packages			**CO1** **CO2**
UNIT III	**Query Processing and Fast Retrieval**	**Periods**: **9**	
Query Processing: Basic Steps, Measures of Query Cost, Query Optimization, Equivalent Expression and Query Evaluation Plan. *Indexing:* Definition, Purpose, Types of Indexing, B Tree and B+ Tree. *Hashing*: Basic Concepts, Hash Function, Static and Dynamic Hashing, Comparison of Indexing and Hashing. *Transaction*: Overview, Transaction States, ACID properties, Implementation of ACID properties, Serializability.			**CO3** **CO4**
UNIT IV	**Concurrency Control and DB Architecture**	**Periods**: **9**	
Concurrency Control: Overview, Lock Types, Lock based Protocols, Deadlock Conditions and Handling. *Recovery Systems*: Failure Classification, Storage, Recovery Algorithms. *Parallel Databases:* Parallelism (I/O, Interquery, Intraquery, Intraoperation, Interoperation) *Distributed Databases:* Homogeneous vs Heterogeneous, Transaction System Architecture, Concurrency control.			**CO3**
UNIT V	**Data mining and Information Retrieval**	**Periods**: **9**	
Data Mining: Association Rules, Classification, Clustering. Data warehouse: Architecture and Schemes. *Information Retrieval*: Ranking (keyword based, Relevance based), Retrieval Effectiveness measures, Web Crawling and Indexing. Introduction to Spatial Databases, Temporal Databases, Multimedia Databases. Case Study: Oracle.			**CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**
Reference Books			

1. Abraham Silberschatz, Henry F. Korth and S.Sudarshan, Database System Concepts, McGraw-Hill International Inc., Sixth edition, 2013.
2. Elmasri and Navathe, Fundamentals of Database Systems, Addison-Wesley, Seventh edition, 2012.
3. Fred R McFadden, Jeffery A. Hoffer and Mary B. Prescott, Modern Database Management, Addison Wesley, 2000.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2	-	1	-	2	1
CO2	2	2	-	2	2	2	2
CO3	1	-	-	-	-	-	-
CO4	1	1	-	-	1	-	-
Avg	1.5	1.67	-	1.5	1.5	2	1.5

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CS208	**Computer Networks**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Demonstrate the layered architecture of network models					Understanding		
	CO2	Categorize the data link and network layer protocols					Analyzing		
	CO3	Interpret the communication issues between end-to-end systems					Understanding		
	CO4	Design applications to establish communication between client and server					Creating		

UNIT I		**Periods** : **9**
Introduction – Uses – Network Hardware – Software – Reference Models – Transmission Media – Wireless Transmission – Electromagnetic Spectrum – Radio Transmission – Digital Modulation		**CO1**
UNIT II		**Periods** : **9**
Data Link Layer – Design Issues – Services - Framing - Error Control - Flow Control - Error Detection and Correction Codes – Hamming Code – Cyclic Redundancy Check - Data Link Layer Protocols - Simplex Protocol – Sliding Window Protocols. Medium Access Control Sublayer – Channel Allocation Problem – Multiple Access Protocols – ALOHA – CSMA Protocols - Collision-Free Protocols - Wireless LAN Protocols. Ethernet MAC Sublayer Protocol – 802.11 MAC Sublayer Protocol - Repeaters, Hubs, Bridges, Switches, Routers, and Gateways		**CO1** **CO2** **CO3**
UNIT III		**Periods** : **9**
Network Layer – Design Issues – Routing Algorithms - The Optimality Principle - Shortest Path Algorithm – Flooding - Distance Vector Routing - Link State Routing. Congestion Control – Approaches - Traffic-Aware Routing - Admission Control - Traffic Throttling - Load Shedding – Internetworking - Tunneling Internetwork Routing - IPv4 - IP Addresses – IPv6.		**CO2** **CO3**
UNIT IV		**Periods** : **9**
Transport Layer - Services - Berkeley Sockets -Example – Elements of Transport Protocols – Addressing Connection Establishment - Connection Release - Flow Control and Buffering–UDP – TCP: Segment Header – Connection Establishment – Connection Release – Sliding Window - Timer Management - Congestion Control.		**CO3** **CO4**
UNIT V		**Periods** : **9**

Application Layer – DNS – Name Space – Resource Records – Name Servers – E-Mail - Architecture and Services - User Agent - Message Formats - Message Transfer - Final Delivery – WWW – Architecture - HTTP – Content Delivery - Server Farms and Web Proxies - Peer-To-Peer Networks. Network Security: Introduction to Cryptography.	**CO3** **CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Tanenbaum, A.S. and David J. Wetherall, Computer Networks, Prentice Hall, Fifth Edition, 2011
2. Larry L. Peterson and Bruce S. Davie, Computer Networks- A System Approach, Elsevier, Fifth Edition, 2012
3. Stallings, Data and Computer Communications, Prentice Hall Int., Tenth Edition, 2013
4. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, Third Edition, 2006

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	1	2	-	-	3		
CO2	1	2	-	-	2		
CO3	1	2	-	-	2		2
CO4	-	2	-	-	3		
Avg	0.75	2	-	-	2.5	2	2

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code :**PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA209	**Operating Systems**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	List the structure and architectural components of Operating System.					Remembering		
	CO2	Apply system calls for managing processes, memory, and the file system.					Applying		
	CO3	Interpret the various process management, memory management, storage management and File system strategies.					Understanding		
	CO4	Compare the available Process Synchronization and Deadlock handling strategies.					Analysing		
	CO5	Appraise the performance of various CPU scheduling algorithms, Disk Scheduling algorithms and Page Replacement algorithms.					Evaluating		

UNIT I	**Fundamentals**	**Periods** : **9**
Introduction - What Operating Systems Do- Overview of Computer System Structure -Operating-System Operations-Resource Management-Security and Protection—Virtualization-Distributed Systems-Kernel Data Structures-Computing Environments- Operating-System Structures-Operating-System Services - User and Operating-System Interface - System Calls - System Services - Linkers and Loaders- Why Applications Are Operating-System Specific - Operating-System Design and Implementation - Operating-System Structure		**CO1**

UNIT II	**Process Management**	**Periods** : **9**
Process Concept-Process Scheduling--Operations on Processes-Interprocess Communication-IPC -in Shared-Memory Systems-IPC in Message-Passing Systems -Communication in Client-Server Systems-Example- Threads & Concurrency- Overview-Multicore Programming-Multithreading –models-Implicit Threading-Threading Issues-Linux Threads-CPU Scheduling- Basic Concepts-Scheduling Criteria -Scheduling Algorithms-Thread Scheduling-Multi-Processor Scheduling-Real Time CPU SchedulingOperating Systems Examples		**CO2 CO3 CO5**

UNIT III	**Process Synchronization**	**Periods** : **9**
Synchronization Tools-Background-The Critical-Section Problem-Peterson's Solution-Hardware Support for Synchronization-Mutex Locks-Semaphores-Monitors-Liveness- Classic Problems of Synchronization-Deadlock- System Model-Deadlock Characterization-Methods for Handling deadlocks-Deadlock Prevention-Deadlock Avoidance-Deadlock Detection -Recovery from Deadlock		**CO2, CO4**

UNIT IV	**Memory Management**	**Periods** : **9**
Main Memory Management- Background-Contiguous Memory Allocation-Paging-Structure of the Page Table-Swapping-Virtual Memory Management- Background-Demand Paging-Copy-on-Write-Page Replacement-Allocation of Frames –Thrashing-Memory-Mapped Files-Allocating Kernel Memory		**CO2 CO3 CO5**

UNIT V	Secondary Storage Management	Periods : 9	
Mass-Storage Systems- HDD Scheduling-NVM Scheduling- Swap-Space Management-File System InterfaceFile Concept-Access Methods-Disk and Directory Structure-File-System Mounting-File Sharing-Protection-File System Implementation- File-System Structure-File-System Operations-Directory Implementation-Allocation Methods-Free-Space Management-File System Internals- File Systems-File-System Mounting-Partitions and Mounting			**CO2** **CO3** **CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, John Wiley, Tenth Edition 2018.
2. William Stallings, Operating Systems: Internals and Design Principles. Prentice-Hall, Seventh Edition, 2012.
3. AS Tanenbaum, Modern Operating Systems, Pearson, Third Edition, 2009.
4. Gary Nutt, Operating Systems: A Modern Perspective, Pearson Publishers, 1997.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1		2				2	
CO2		1				2	3
CO3		1					
CO4		1					1
CO5	3						
Avg	0.6	1				0.8	0.8

Score : **3**-High; **2**-Medium; **1**-Low

Department: **HS**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
HS203	**Communication Skills**		**2**	**-**	**2**	**3**	**100**	**-**	**100**
Prerequisite	-								
Course Outcome	**CO1**	Illustrate the significance of communication in personal & professional success.					Understand		
	CO2	Identify strategies for effective listening and speaking					Applying		
	CO3	Apply different reading techniques for improved comprehension					Applying		
	CO4	Develop appropriate competence in written communication in English					Applying		
	CO5	Develop the requisite skills for facing interviews and group discussions					Creating		

UNIT I	**Understanding Communication**	**Periods** : **6**
Definition - Importance - Process- Types - Purpose– Inter/ Intra personal Communication - Barriers to communication - Communication in Management		**CO1**
UNIT II	**Listening and Speaking**	**Periods** : **6**
Importance of Listening – Types - Hearing vs Listening - Barriers to listening Presentation skills – extempore speaking - Tools of persuasion - Negotiation Techniques		**CO2**
UNIT III	**Reading**	**Periods** : **6**
Comprehension - Reading Styles: skimming - scanning - SQ3R - intensive and extensive reading -inferring note making		**CO3**
UNIT IV	**Writing**	**Periods** : **6**
Formal and informal writing – Sentence construction - Paragraphs- Essays - Reports - Emails - Resumes Agenda and Minutes of a meeting		**CO4**
UNIT V	**Soft Skills**	**Periods** : **6**
Introduction to soft skills Group discussions: Purpose , Process and Preparation Interviews : Types , Planning, Dressing and Grooming- TIPS – Mock interviews		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Kumar, Sanjay and PushpaLatha, Communicative Skills, , Oxford University Press, Second Edition 2015. 2. Murphy, Herta,HerbertHildebrandt et al, Effective Business Communication**,** SIE Paperback, 2017
3. Butterfield, Jeff, Soft Skills for Everyone, Cengage Learning , 2010.
4. Taylor, Shirley, Communication for Business: A Practical Approach, Pearson Ltd, 2010.

Web references:
https://www.thebalancecareers.com/communication-skills-list-2063779 https://www.mindtools.com https://www.skillsyouneed.com

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1				3	1		
CO2				3			
CO3				2			
CO4				3			
CO5				3			
Avg				2.8	0.2		

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA210	**Database Management System Laboratory**		-	-	4	2	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Solve queries to perform transactions using SQL, PL/SQL related to a specific application					Applying		
	CO2	Design a database system using ER model for a specific application by transforming to a relational model					Creating		
	CO3	Demonstrate DBA commands to fine tune database performance					Understanding		

List of Experiments :

1. Study of Database Concepts: Relational model – table – operations on tables – index – table space – clusters – synonym – view – schema – data dictionary – privilege – role – transactions.	**CO1**
2. Study of SQL: Primitive Data Types – User Defined data Types – create, alter, drop, select, insert, delete, update, commit, rollback, save point, grant, revoke - Built-in Functions – Integrity Constraint – Authorization – Transactions	**CO2**
3. Study of Query Types: Queries involving Set Operators: Union, Intersection, Difference, Cartesian product, and Divide Operations – Sub Queries – Join Queries – Nested Queries – Correlated, Queries – Recursive Queries.	**CO3**
4. Study of Procedural Query Language: Blocks, Exception Handling, Functions, Procedures, Cursors, Triggers, Packages.	**CO4**
5. Design and develop the following application: a. Library Information System b. Hospital Management System c. Student's Information System d. Employee Information System.	**CO5**

Lecture Periods:	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods: 60**

Reference Books

1. Abraham Silberschatz, Henry F. Korth and S.Sudarshan, Database System Concepts, McGraw-Hill International Inc., Sixth edition, 2011.
2. https://www.tutorialspoint.com/sql/index.htm
3. https://www.w3schools.com/sql/

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	2	2	-	-	2	2	-

CO2	2	2	-	2	2	2	1
CO3	-	1	-	-	-	1	1
Avg	2	1.67	-	2	2	1.67	1

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**					
Semester: **Second**			Course Category Code: **PCC**			Semester Exam Type: **LB**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks	
			L	T	P		CA	SE	TM
CA211	**Operating Systems and Computer Networks Laboratory**		-	-	4	2	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Demonstrate the system calls in the Linux operating system					Understanding		
	CO2	Develop programs for CPU scheduling, Disk scheduling and process management algorithms of operating system					Applying		
	CO3	Develop programs for data link and network layer protocols					Applying		
	CO4	Design applications to establish communication between client and server using TCP and UDP					Creating		

List of Experiments :	
1. Study of basic Linux Commands 2. Implementation of Shell Programming 3. Implementation of System Calls	**CO1**
4. Implementation of various processor and Disk Scheduling Techniques 5. Implementation of Inter-Process Communication mechanism 6. Implementation of Process Synchronization using semaphores	**CO2**
7. Implementation of a Program for CRC and Hamming Code for Error Handling.	**CO3**
8. Simulating Sliding Window Protocols, Shortest Path Routing, Link State routing protocols 9. Implementation of a socket program for Echo/Talk commands 10. Creation of a Socket between two Computers and Enable File Transfer between them using. a. TCP and b. UDP	**CO4**
11. Create a Socket For HTTP for Web Page Upload & Download 12. Create a Socket For HTTP for Web Page Upload & Download 13. Implementation of TELNET. (Remote Login)	**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods: 60**

Reference Books

1. Tanenbaum, A.S. and David J. Wetherall, Computer Networks, Prentice Hall, Fifth Edition, 2011.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks- A System Approach, Elsevier, Fifth Edition, 2012.
3. Stallings, Data and Computer Communications, Prentice Hall Int. Ed., Tenth Edition, 2013.
4. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, Third Edition, 2006.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2	2	-	-		
CO2	2	2	2	-	-		
CO3	2	2	2	-	-		
CO4	2	2	2	2	2		
Avg	2	2	2	0.25	0.25		

Score:**3**-High; **2**-Medium;**1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA212	**Internet and Web Programming**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Explain the working of Internet architecture and protocols					Understand		
	CO2	Apply HTML and scripts to develop Interactive web pages					Applying		
	CO3	Develop dynamic web pages using server-side programming language					Applying		
	CO4	Build fast and dynamic web sites using PHP and AJAX					Creating		

UNIT I	**Internet basics and HTML5**	**Periods** : **9**
Introduction: History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser. HTML5: Introduction, Why HTML5? Formatting text by using tags, using lists and backgrounds, Creating hyperlinks and anchors, Style sheets, CSS formatting text using style sheets, formatting paragraphs using style sheets. HTML5 Page layout, Navigation, Tables, Forms and Media.		**CO1 CO2**
UNIT II	**Java Script and jQuery**	**Periods** : **9**
Java Script: Introduction, Operators, Statements, Functions, Arrays, Objects, Events and Event Handlers. jQuery: Introduction, Selectors, Traversing, Manipulation, Events, Effects		**CO2**
UNIT III	**Introduction to PHP**	**Periods** : **9**

PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, super global arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems.		**CO3**
UNIT IV	**Advanced PHP and MySQL**	**Periods** : **9**
PHP/MySQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and File handling.		**CO3**
UNIT V	**PHP and AJAX**	**Periods** : **9**
AJAX Basics : HTTP Request and Response Fundamentals, The XML Http Request Object, XML Http Request Methods, XML Http Request Properties , Cross-Browser Usage , Sending a Request to the Server. PHP and Ajax: Why PHP and Ajax? , Client-Driven Communication, Server-Side Processing , Examples :Expanding and Contracting Content , Auto-Complete , Form Validation.		**CO3** **CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Johnson, Glenn. Programming in HTML5 with JavaScript and CSS3. Microsoft Press, 2013.
2. Nixon, Robin. Learning PHP, MySQL, JavaScript, and CSS: A step-by-step guide to creating dynamic websites, O'Reilly Media, Inc., 2012.
3. Babin, Lee. Beginning Ajax with PHP: From novice to professional. Apress, 2007.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	2	1	1	1		
CO2	3	3	2	1	2		
CO3	2	3	2	1	2		
CO4	2	3	2	1	2		
Avg	2.5	2.75	1.75	1	1.75		

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**		Programme: **M.C.A.**						
Semester**: Third**		Course Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CA213	**Mobile Application Development**	3	-	-	3	40	60	100
Prerequisite	Knowledge on Programming tools and techniques Understanding the basics of android devices, GUI							

Course Outcome	**CO1**	Develop mobile application using Android studio with activities and fragments	Creating
	CO2	Apply Android User Interface components programmatically	Applying
	CO3	Design mobile application with menus, images and database	Creating
	CO4	Make use of Multimedia, Messaging and Location based services	Applying
	CO5	Build application with Android networking and communication between android components	Creating

UNIT I		**Periods** : **9**
Android Introduction and features, required tools – Using Android studio for Android development – Exploring IDE, Coding, debugging and publishing the Android application Activities, Fragments and Indents – understanding activities – Linking activities using intents- Fragments – displaying notifications		**CO1**
UNIT II		**Periods** : **9**
Android User Interface – Understanding the components of a screen, Adapting to display orientation, Managing changes to screen orientation – Utilizing the Action Bar, Creating the user interface programmatically, Listening for user notifications Designing UI with views – Basic views, Picker views, List views to display long lists, specialized fragments		**CO2**
UNIT III		**Periods** : **9**
Displaying pictures and menus with views – Image views, Menus, Web views Data persistence – Saving and Loading user preferences, Persisting data to files, creating and using databases		**CO3**
UNIT IV		**Periods** : **9**
Sharing data in Android – Using and creating content provider Messaging – SMS messaging – Sending Email Location based services – Displaying Maps, Getting location data, Monitoring a location		**CO4**
UNIT V		**Periods** : **9**
Networking – Consuming Web services using HTTP, Consuming JSON services Developing Android services – Creating own services, Establishing a communication between a service and an activity, Binding activities to services, Understanding threading		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. J. F. DiMarzio, Beginning Android Programming with Android Studio, John Wiley & Sons Inc., Indiana, 2017 2. Zigurd Mednieks, Laird Dornin, G,Blake Meike and Masumi Nakamura Programming Android, O'Reilly, 2011.
3. Reto Meier, Professional Android 2 Application Development, Wrox Wiley, 2010.
4. Alasdair Allan, iPhone Programming, O'Reilly, 2010.
5. Wei-Meng Lee, Beginning iPhone SDK Progrmming with Objective-C, Wrox Wiley, 2010.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2

CO1	2	3	1	1	2	3	3
CO2	1	2	2	1	1	3	3
CO3	2	2	2	1	1	3	3
CO4	2	3	2	1	2	3	3
CO5	2	3	2	1	2	3	3
Avg	1.8	2.6	1.8	1	1.6	3	3

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code:**PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA214	**Web Programming Laboratory**		-	-	4	2	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Apply HTML and stylesheet features to design a webpage					Applying		
	CO2	Create Interactive web pages using client side scripting					Creating		
	CO3	Develop dynamic websites using client and server-side scripting					Creating		

List of Experiments :

1. Write an HTML5 code to display your Curriculum Vitae on a web page. 2. Write an HTML5 code to create a Home page having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links 3. Write an HTML5 code to illustrate the usage of the following: Ordered List, Unordered List and Definition List. 4. Write an HTML5 and CSS code to demonstrate the usage of different style sheets. 5. Write an HTML5 code to display your education details in a tabular format.	**CO1**
6. Write a JavaScript program to design a simple calculator to perform the following operations: addition, subtraction, multiplication and division. 7. Write Java Script program to calculate the number of characters, words and lines in the text entered by a user. 8. Write Java Script program to validate a registration form designed using HTML5. 9. Write programs using jQuery to demonstrate Selectors, Traversing, Manipulation, Events, Effects	**CO1** **CO2**
10. Write PHP programs to demonstrate the control structures, branching and looping statements. 11. Write PHP programs to demonstrate arrays and functions. 12. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings. 13. Write a PHP program to sort the student records which are stored in the database. 14. Write a PHP program to validate a User name and Password in a Login Page created using HTML5. 15. Write a program to demonstrate Form submission Using Ajax, PHP, MySQL and jQuery.	**CO1** **CO2** **CO3**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods:60**

References

1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/web_development_tutorials.htm

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	3	2	1	2		

CO2	2	3	2	1	2		
CO3	2	3	2	2	2		
Avg	2.33	3.00	2.00	1.33	2.00		

Score : **3**-High; **2**-Medium; **1**-Low

<table>
<tr><td colspan="4">Department: Computer Science and Engineering</td><td colspan="4">Programme: M.C.A.</td></tr>
<tr><td colspan="4">Semester: Third</td><td colspan="2">Course Category Code: PCC</td><td colspan="2">Semester Exam Type: LB</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Periods / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td></td><td>CA</td><td>SE</td><td>TM</td></tr>
<tr><td>CA215</td><td>Mobile Application Development Laboratory</td><td>-</td><td>-</td><td>4</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td>Prerequisite</td><td colspan="8">Knowledge on Programming tools and techniques</td></tr>
<tr><td rowspan="5">Course Outcome</td><td>CO1</td><td colspan="5">Demonstrate various Mobile application development tools</td><td colspan="2">Understanding</td></tr>
<tr><td>CO2</td><td colspan="5">Design forms using User interface controls</td><td colspan="2">Creating</td></tr>
<tr><td>CO3</td><td colspan="5">Develop mobile application with menus, images and database</td><td colspan="2">Applying</td></tr>
<tr><td>CO4</td><td colspan="5">Make use of Multimedia, Messaging and Location based services</td><td colspan="2">Applying</td></tr>
<tr><td>CO5</td><td colspan="5">Build application with Android networking and communication between android components</td><td colspan="2">Creating</td></tr>
<tr><td colspan="8">List of Experiments:</td></tr>
<tr><td colspan="7">1. Survey of Mobile Application Development Tools.</td><td>CO1</td></tr>
<tr><td colspan="7">Using J2ME and Android SDK framework
2. Form design for mobile applications.
3. Applications using controls.
4. Graphical and Multimedia applications.
5. Implement an application that implements Multithreading
6. Location based and map integration applications</td><td>CO2
CO3
CO4</td></tr>
<tr><td colspan="7">7. Data retrieval/Database applications.
8. Implement an application that writes data to the SD card.
9. Write a mobile application that creates alarm clock
10. Implement an application that creates an alert upon receiving a message and Networking applications</td><td>CO3
CO5</td></tr>
<tr><td colspan="2">Lecture Periods: -</td><td colspan="2">Tutorial Periods: -</td><td colspan="2">Practical Periods: 60</td><td colspan="2">Total Periods:60</td></tr>
<tr><td colspan="2">References:-</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2						3
CO2	2						3
CO3		2				2	3
CO4	1	2	1			1	3
CO5	2	2				2	3
Avg	1.4	1.2	0.2			1	3

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester**: Third**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA216	**Mini Project**		-	-	2	1	100	-	100
Prerequisite	Knowledge on Programming tools and techniques								
Course Outcome	**CO1**	Apply theoretical and practical tools/techniques to solve real life problems related to industry and academic institutions.					Applying		
	CO2	Develop the SRS					Creating		
	CO3	Compare different strategies for design					Analysing		
	CO4	Translate the design using appropriate tools and software for implementation					Understanding		
	CO5	Evaluate the developed system					Evaluating		

List of Experiments :

The students are expected to develop application oriented small-scale projects, through which students explore their technical skills**.** The students shall carry out the project assigned to them and submit a report at the end of the semester for continuous assessment.	**CO1-CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods:30**

References:-

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2

CO1	**1**	**1**				**2**	
CO2		**1**				**3**	
CO3		**1**				**2**	
CO4						**3**	
CO5					**1**	**1**	
Avg	0.2	0.6			**0.2**	**2.2**	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Fourth**			Course Category Code: **PAC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CA217	**Comprehensive Viva Voce**		-	-	4	2	40	60	100
Prerequisite									
Course Outcome	**CO1**	Take part confidently appear for placement interviews					Analysing		
	CO2	Take part in competitive exams for higher studies					Analysing		
	CO3	Recall various aspect of Computer science					Remembering		

The comprehensive viva-voce is intended to test the domain knowledge of the students, pertaining to the subjects covered in the previous semesters. This viva-voce also prepares the students for their competitive examinations, placements and also enables them to self-assess their domain knowledge.	**CO1-CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: -**

Reference Books

Test Books prescribed for the courses in the respective syllabus from I to III semester

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	1			2		

CO2	2	2		2	1		
CO3	2	1			3		
CO4				3			
CO5	2				2		
Avg	1.8	0.8		1	1.6		

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**					
Semester: **Fourth**			Course Category Code: **PAC**			Semester Exam Type: **PR**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks	
			L	T	P		CA	SE	TM
CA218	**Project Work & Dissertation**		-	-	-	12			
Prerequisite								
Course Outcome	**CO1**	Plan and carry out research appropriate to a project				Applying		
	CO2	Show Project Planning				Understanding		
	CO3	Create a practical solution to a problem, making effective use of time and resources available.				Creating		
	CO4	Develop personal learning				Applying		
	CO5	Demonstrate good oral communication skills and documentation skills				Understanding		

Students will be continuously monitored and assessed regarding the progress of their work and will be advised suitably through a panel of review committee. Students should: 1. Select a Real time Application/ Industrial problem. 2. Perform a feasibility study. 3. Define the Problem Statement and Objectives. 4. Detailed Design of the Proposed Solution. 5. Finalize the Experimental Environment. 6. Implementation of the Proposed Solution/ Work 7. Software Testing against requirements gathered from users and system specifications 8. Documentation of the project and the results in the prescribed format 9.Submission of the project report	**CO1-CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:-**

Reference Books

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3						
CO2		3				3	
CO3		3		2		3	
CO4					2	2	
CO5				3			
Avg	0.6	1.2		1	0.4	1.6	

Score: **3**-High; 2-Medium; **1**-Low

Programme Specific Electives (PSE)

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code: **PSE-1**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ01	**Advanced Java Programming**		3	-	-	3	40	60	100
Prerequisite									
Course Outcome	**CO1**	Demonstrate interactive user interfaces using the Java classes and appropriate layout managers.					Understanding		
	CO2	Illustrate the various features of Java packages such as util, awt and swing					Understanding		
	CO3	Develop Java programs to access database using Java database connectivity.					Applying		
	CO4	Design web applications using servlets and Java Beans.					Creating		

UNIT I	**GUI Programming**	**Periods** : **9**
GUI Programming : Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package)**.The Collection Framework :** Collections of Objects , Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of Array List & Vector		**CO1 CO2**

UNIT II	**Windows Based Applications With Java**	**Periods** : **9**
Working with java.awt Package: Exploring the component Class – Container Class -Panel Class – Window Class – Frame Class. Creating Desktop Application using AWT: Frame Window – Button Class – Label and Text Field Classes – Check Box and Radio Button Classes – Scroll bar class – Choice Class – Text Area Class – Panel Container. Creating a Desktop Application using Swing: Implementing the JFrame Class -JButton Class – Jlabel – JTextField – JtextArea – JTable – JTabed Pane Class. Implementing the Layout Manager: Flow Layout Manager – Border Layout – Grid Layout – Grid Bag Layout Manager		**CO1 CO2**

UNIT III	**Java Database Connectivity**	**Periods** : **9**
JDBC Package: JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection -Statement – Prepared Statement. Result Set : Fields of Result Set – Methods of Result Set – Executing a query – Result Set Meta Data – Database Meta Data. Data types in JDBC : Basic data types in JDBC – Advanced data types in JDBC – fields of Statement – methods of Statement – Callable Statement Interface – Batch Updates.		**CO3**

UNIT IV	**Java Server Technologies Servlet**	**Periods** : **9**
Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Exploring Deployment. Descriptor (web.xml), Handling Request and Response.		**CO4**

UNIT V	Java Beans	Periods : 9
Concepts of Java Beans: Java Beans – Advantage of Java Beans – Reflection and Introspection – Customizers – Persistence. Developing Java Beans : Bean Developer Kit (BDK) – Creating a Java Bean – Creating a Bean Manifest file – Creating a Bean JAR file. Controls and Properties of a Bean: Adding controls to Beans – Giving Bean Properties – Bean Info interface – Simple Bean Info class. Types of Properties: Design pattern for Properties: Simple properties – indexed Properties; Descriptor Classes – Giving Bean methods – Bound and Constrained Properties – Property Editors		CO4

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Reference Books

1. Steven Holzner, Java 2 Black Book, Paraglyph Press, USA, 2008
2. Deitel and Harvey Deitel, Java SE 8 for Programmers, Paul, Prentice Hall, 2014
3. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java 8 in Action, Manning Publications, 2014
4. Cay S. Horstmann. Gary Cornell. Upper Core Java, Volume II--Advanced Features, 9th Edition, Core Series Paperback 2013.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	3	-	-	2	2	1
CO2	1	2	-	-	2	1	-
CO3	2	3	-	-	2	2	1
CO4	2	3	-	-	2	2	2
Avg	**1.75**	**2.75**			**2**	**1.75**	**1.33**

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code:**PSE-1**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ02	**Python Programming**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Develop proficiency in creating basic applications using Python					Applying		
	CO2	Categorize various data structures and debugging features available in Python programming language					Analysing		
	CO3	Build applications with Object Oriented Concepts in python					Creating		
	CO4	Examine plots and understand threads and networking in python					Analysing		
	CO5	Apply security measures and design applications with GUI in Python					Applying		
UNIT I	**Basics of Python**						**Periods** :**9**		
Introduction: Basic elements of python; Control Structures; Strings and Inputs. Functions, Scoping and Abstraction: nFunctions and scoping; Specifications; Recursion; Global variables; Modules; Files; System Functions and Parameters.									**CO1**
UNIT II	**Data structures and Debugging**						**Periods** :**9**		
Structured Types, Mutability and Higher-Order Functions: Tuples; Lists and Dictionaries; Lists and Mutability; Functions as Objects. Testing, Debugging, Exceptions and Assertions: Types of testing; Black-box and Glass-box; Debugging; Handling Exceptions; Assertions.									**CO2**
UNIT III	**Object Oriented Programming**						**Periods** :**9**		
Classes and Object-Oriented Programming: Abstract Data Types and Classes; Inheritance; Polymorphism; Encapsulation and Information Hiding									**CO3**
UNIT IV	**Regular Expressions, plots and Networking**						**Periods** :**9**		
Regular Expressions – REs and Python; Plotting using PyLab; Networking and Multithreaded Programming – Sockets; Threads and Processes; Chat Application									**CO4**
UNIT V	**Security and GUI**						**Periods** :**9**		
Security – Encryption and Decryption; Classical Cyphers; Graphics and GUI Programming; Drawing using Turtle, Tkinter and Python; Other GUIs; Database Access.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		
Reference Books									

1. John V Guttag, Introduction to Computation and Programming Using Python, Prentice Hall of India,2016
2. R. Nageswara Rao, Core Python Programming, Dreamtech, 2018
3. Wesley J. Chun. Core Python Programming , Second Edition, Prentice Hall,2006.
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in python, Wiley, 2013.
5. Kenneth A. Lambert, Fundamentals of Python – First Programs through Data Structures, CENGAGE Publication, 2009
6. Luke Sneeringer, Professional Python, Wrox, First Edition, 2015.
7. Al Sweigart , Hacking Secret Ciphers with Python, Createspace Independent Publishing Platform; First edition,2013.
8. URLhttps://inventwithpython.com/hacking/

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3				2	
CO2	2						
CO3	3	2		2		2	
CO4	2	2				2	
CO5	2	3		2		2	
Avg	2.4	2		0.8		1.6	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code**: PSE-1**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ03	**Embedded Systems**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Recall the basics of embedded systems.					Remembering		
	CO2	Demonstrate the architecture features of Arduino platform					Understanding		
	CO3	Build embedded systems with concepts learned					Creating		
	CO4	Summarize contemporary state-of-art platform for embedded systems					Understanding		
	CO5	Translate the theoretical concepts into practical use cases.					Understanding		
UNIT I	**Introduction to Embedded Systems**					**Periods** : **9**			
General Purpose versus Embedded Systems – Examples – Microprocessors versus Microcontrollers – Interrupts – Direct Memory Access – Memory Hierarchy – Real-time OS – Code Optimization.									**CO1**
UNIT II	**Designing with Arduino - I**					**Periods** : **9**			
Origins of Arduino – Architectural features – Arduino family – Hardware features – Analog and Digital I/O functions – Timer and Interrupts – Sensors – Communication functions – Actuators									**CO2**
UNIT III	**Design with Arduino - II**					**Periods** : **9**			
IoT Design Methodology – Specification Developing arduino sketches – Arduino Library for C – Bit manipulations – Interrupts – File Management – Storage – Audio/Video streaming – Control of DC and Stepper motors.									**CO3**
UNIT IV	**Design with Raspberry Pi**					**Periods** : **9**			
Raspberry Pi – Hardware – Software – Embedded Linux – Rpi file system – C/C++/Python codes for controlling LED through GPIO – Eclipse IDE.									**CO4**
UNIT V	**Communications and Case Studies**					**Periods** : **9**			
NodeMCU Wireless – USB – Serial I/O - RPi Xbee – RFID – Air quality monitor using Arduino – Intelligent Lock System using Arduino – Design of Robots									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. David E. Simon, An Embedded Software Primer, Pearson Education, 2002.
2. Simon Monk, Programming Arduino – Getting started with sketches, McGraw Hill, 2016.
3. Tianhong Pan and Yi Zhu, Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Springer, 2019.
4. Derel Molloy, Exploring Raspberry Pi, Wiley, 2016.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3						
CO2	3						
CO3	3	2					
CO4	2						
CO5	2	2					
Avg	2.6	0.8					

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**	Programme: **M.C.A.**

Semester: **Second**			Course Category Code: **PSE -1**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ04	**Graphics and Image Processing**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	List the aspects computer graphics system, design algorithms and transformations				Remembering			
	CO2	Compare various image storage, sampling, frequency domain processing , enhancement and restoration operations .				Analysing			
	CO3	Illustrate mathematical modeling of image compression and segmentation.				Understanding			

UNIT I	**Graphics Systems and Graphical User Interface**	**Periods** : **9**
Pixel – Resolution– Types of Video Display Devices – Graphical Input Devices – Graphical Output Devices – Hard Copy Devices – Direct Screen Interaction – Logical Input Function – GKS User Dialogue –Interactive Picture Construction Techniques		**CO1**
UNIT II	**Display Primitives and Transformations**	**Periods** : **9**
Geometric Display Primitives and Attributes: Geometric Display Primitives – Points– Lines and Polygons– Point Display Method – Line Drawing Methods – Circle Methods. 2D Transformations and Viewing: Types of Transformations – Matrix Representation – Concatenation – Scaling– Rotation – Translation–Shearing – Mirroring– Homogeneous Coordinates Transformations. Window to View Port Transformations: Windowing And Clipping: Point – Lines– Polygons – Boundary Intersection Methods.		**CO1**
UNIT III	**Digital Image Fundamentals**	**Periods** : **9**

Nature of Image Processing and Its Applications – Image Representations – Image Types – Image Processing Operations – Image Acquisition – Image Sampling and Quantization – Image Quality –Image Storage and File Formats – Image Processing Operations – Need for Image Transforms – Fourier Transforms and Its Properties – Haar Transforms and Its Applications			**CO2**
UNIT IV	**Image Enhancement and Restoration**	**Periods** : **9**	
Need for Enhancements – Point operations – Histogram Techniques – Spatial filtering concepts –Frequency Domain Filtering – Image Smoothening – Image Sharpening - Image degradation and Noise Models – Introduction to Restoration Techniques			**CO2**
UNIT V	**Image Processing Activities**	**Periods** : **9**	
Image Compression: Compression Models and Measures – Coding Types – Types of Redundancy –Lossless Compression Algorithms – Lossy Compression Algorithms – Introduction to Compression Standards. Image Segmentation: Detection of Discontinuities – Edge Detection – Thresholding –Region Based Segmentation – Introduction to Color Image Processing – Introduction to Morphological Operations and Image Processing Framework.			**CO3**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Donald D. Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education, 2014. 2. Rafael C. Gonzalez, Digital Image Processing using Matlab, McGraw Hill Education, 2017
3. S. Sridhar, Digital Image Processing, First Edition, Oxford Press, 2011.

CO-PO Mapping

Score : **3**-High; **2**-Medium; **1**-Low

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	2				2		
CO2	3	1	1		2		
CO3	3	1	1	3	2		
Avg	2.7	0.66	0.66	1	2		

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code**:PSE-2**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ05	**Artificial Intelligence**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Analyse the blind, heuristic and adversarial search techniques to find optimal solutions for complex problems.					Analysing		
	CO2	Analyse the knowledge representation techniques and reasoning systems for logic programming.					Analysing		
	CO3	Examine the different ways of designing software agents.					Analysing		
	CO4	Create autonomous intelligent models that use learning and planning strategies for decision making in various application domains of AI.					Creating		

UNIT I	**Introduction and search Techniques**	**Periods**: **9**
Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving through search: state-space - Blind search techniques: BFS, DFS, UCS, Heuristic search techniques: Best-first search, Greedy search, A* search, AO* search- Adversarial search: Mini-max search		**CO1 CO4**
UNIT II	**Knowledge Representation**	**Periods**: **9**
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information		**CO2 CO4**
UNIT III	**Software Agents**	**Periods**: **9**
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.		**CO3 CO4**
UNIT IV	**Planning and Learning**	**Periods**: **9**
Planning: State space planning - partial order planning - Planning graphs - Conditional planning- Continuous planning, Planning under uncertainty - Learning Types: Rote Learning, Learning by taking advice, Explanation based learning, Discovery, Analogy - Supervised and Unsupervised learning -Decision trees based learning – Reinforcement Learning.		**CO4**
UNIT V	**Applications of Artificial Intelligence**	**Periods**: **9**
Expert Systems: Characteristics - Building blocks- Case Study, Intelligent agents: Agent Environment- Case Study - Robotics: Hardware, Perception, Planning - Natural Language Processing: Text classification, Information Retrieval and Information Extraction.		**CO3 CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

CO-PO Mapping

Reference Books

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education Private Limited, First Edition, 2016 2. ParagKulkarni and Prachi Joshi, Artificial Intelligence: Building Intelligent Systems, PHI Learning Private Limited, 2015.
3. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approachǁ, Prentice Hall, Third Edition, 2015.

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	2	-	1	-	2	1
CO2	3	2	-	1	-	2	1
CO3	2	2	-	2	-	2	1
CO4	2	3	-	2	2	3	2
Avg	2.5	2.25	-	1.5	2.0	2.25	1.25

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Second**			Course Category Code: **PSE-2**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ06	**Automata Theory and Computation**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Design the language accepted by an automata or generated by a regular expression or a context-free grammar.					Creating		
	CO2	Make use of pumping lemma to show that a language is not regular / not context-free.					Applying		
	CO3	Design automata, push down automata and Turing Machine for accepting or generating a certain language.					Creating		
	CO4	Construct parser for a given input code using suitable parsing techniques.					Creating		
	CO5	Appraise concepts relating to the theory of computation and computational models, including decidability and intractability.					Evaluating		

UNIT I	**Finite Automata and Regular Expressions**	**Periods** : **9**
Formal Languages and Regular expressions, Regular Expressions in programming languages, Deterministic and Non-Deterministic Finite Automata, Finite Automata with ε-moves, Conversion of NFA and DFA, Minimization of Finite Automata, Applications of Finite Automata, Implementation of Lexical Analyzer.		**CO1 CO3**
UNIT II	**Regular Sets and Context Free Grammars**	**Periods** : **9**
Chomsky hierarchy, Properties of regular sets, Pumping Lemma for regular languages, Context-Free Grammars – Derivation trees, Ambiguous and unambiguous grammars, Normalization of Context Free Grammar-Chomsky Normal Form and Greibach Normal Form, Context-Free Grammars for Programming Languages.		**CO2**
UNIT III	**Pushdown Automata**	**Periods** : **9**
Introduction on pushdown automata, Deterministic and Nondeterministic pushdown automata, Acceptance by PDA, Equivalence between pushdown automata and context-free grammars, Applications of pushdown automata.		**CO1**
UNIT IV	**Parser**	**Periods** : **9**
Introduction on Parser, Top-down parsing and Bottom-up parsing, Operator Precedence Parser, Automatic Construction of Efficient Parser – Predictive Parser, LL(1) Parser, LR Parser, SLR Parser		**CO3 CO4**
UNIT V	**Turing machines**	**Periods** : **9**

CO-PO Mapping

Turing machines (TM) – computable languages and functions –Turing Machine constructions –Programming techniques for TM, Variations of TMs – Time and Space complexity of TMs –Complexity classes – Introduction to NP-Hardness and NP-Completeness	**CO3 CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishers, 2002.
2. Michael Sipser, Introduction to the Theory of Computations, Cengage Publisher, Third edition, 2014.
3. John C. Martin, Introduction to Languages and the Theory of Computation, Tata McGraw-Hill, 2003.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	2	1
CO2	2	2	-	-	-	-	-
CO3	2	2	-	-	-	-	-
CO4	2	2	2	-	-	2	-
CO5	3	2	2	2	2	-	1
Avg	2.4	2	2	1.5	-	2	1

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C. A.**						
Semester: **Second**			Course Category Code:**PSE-2**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ07	**Data Science and Analytics**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Explain the key concepts in data science and the big data analytics						Understanding	
	CO2	Examine the relationships within the data using various analytical methods						Applying	
	CO3	Analyze tool and technologies used for data analytics and visualization						Analyzing	

UNIT I	**Introduction to Data Science**	**Periods**: **9**
Introduction: Data Science -Big Data and Data Science Hype - Datafication - The Current Landscape - Data Scientist Perspective: In Academia and Industry - Statistical Inference: Populations and Samples -Populations and Samples of Big Data - Big Data Can Mean Big Assumptions -Modeling - Exploratory Data Analysis - Philosophy of Exploratory Data Analysis - The Data Science Process.		**CO1**
UNIT II	**Big Data analytics**	**Periods**: **9**
Big Data overview: Big Data characteristics - Big data examples -Types of analytics - State of the practice in analytics - Business Intelligence versus Data Science - Roles for the new Big Data ecosystem -The Data Scientist Examples of Big Data analytics - Data Analytics Lifecycle: Discovery - Data preparation - Model planning - Model execution - Communicate results -Operationalize.		**CO1**
UNIT III	**Analytical Theory and Methods**	**Periods**: **9**
Regression: Linear Regression - Logistic Regression - Reasons to Choose and Cautions– Classification - Decision Trees -Na'ive Bayes - Diagnostics of Classifiers–Clustering - Overview of Clustering - K-means– Association RulesOverview - A priori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing - Diagnostics.		**CO2**
UNIT IV	**Analytics Technology and Tools**	**Periods**: **9**
Analytics for Unstructured Data - Use Cases - MapReduce - Apache Hadoop - The Hadoop Ecosystem - NoSQL SQL Essentials - In-Database Text Analysis - Advanced SQL.		**CO3**
UNIT V	**Data Visualization and Basic Data Analytic Methods Using R**	**Periods**: **9**
Communicating and Operationalizing an Analytics Project - Creating the Final Deliverables - Data Visualization Basics. Basic features of R - Data exploration and analysis with R - Statistical methods for evaluation		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**
Reference Books			

CO-PO Mapping

1. Cathy O"Neil and Rachel Schutt, Doing Data Science, Straight Talk from The Frontline, O"Reilly, 2013.
2. David Dietrich, Barry Heller & Beibei Yang, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, 2015.
3. Arshdeep Bahga& Vijay Madisetti, Big Data Analytics: A Hands-On Approach, VPT, 2018.
4. Joel Grus, Data Science from Scratch, O"Reilly, Second Edition,2019.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	1	2	1	1	1		
CO2	1	2	2	1	2		
CO3	2	3	1	2	2		
Avg	1.33	2.33	1.33	1.33	1.67		

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**		Programme: **M.C.A.**						
Semester: **Second**		Course Category Code:**PSE-2**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CAZ08	**Multimedia Systems and Tools**	3	-	-	3	40	60	100
Prerequisite	-							

Course Outcome	**CO1**	Demonstrate the principles and current technologies of multimedia systems, use of animation, digitized sound, video control, and scanned images.	Understanding
	CO2	Perceive knowledge on compression standards, multimedia representation, data formats	Evaluating
	CO3	Recall various aspects of operating systems and networking used for multimedia	Remembering
	CO4	Outline the requirement and synchronization techniques for multimedia applications	Understanding
	CO5	Design and develop various applications using multimedia tools	Creating

UNIT I	**Introduction to Multimedia Systems**	**Periods**: **9**
Multimedia: Media And Data Streams -Medium -Main Properties of a Multimedia System – Multimedia .Traditional Data Streams Characteristics -Data Stream Characteristics for continuous Media - Information Units Sound/Audio : Basic Sound Concepts- Music - MIDI :Basic Concepts , Devices, Messages ,MIDI and SMPTE Timing Standards -Software Speech : Generation, Analysis, Transmission Images and Graphics : Basic Concepts, Computer Image Processing Video and Animation : Basic Concepts - Television -Computer-Based Animation		**CO1**
UNIT II	**Data Compression**	**Periods**: **9**
Storage Space -Coding Requirements Source, Entropy and Hybrid Coding, Some Basic Compression Techniques - JPEG - H.261 (px64) - MPEG - DVI. Optical Storage Media: Basic Technology- Video Disks and Other Worms Compact Disk Digital Audio - Compact Disk Read only Memory -CD-ROM Extended Architecture - Further CD-ROM based Developments - Compact Disk Write Once - Compact Disk Magneto Optical -Computer Technology		**CO2**
UNIT III	**Multimedia Operating and Networking Systems**	**Periods** : **9**
Introduction -Real Time - Resource Management -Process Management - File Systems – Interprocess Communication and Synchronization -Memory Management -Device Management- System Architecture Networking Systems : Layers, Protocols and Services Networks - Local Area Networks(LANs) -Metropolitan Area Networks (MAN's) - Wide Area Networks - ISDN: ATM. Multimedia Communication Systems Application Subsystem - Transport Subsystem - Quality of Service and Resource Management		**CO3**
UNIT IV	**Synchronization and Multimedia Applications**	**Periods** : **9**

Introduction - Notion of Synchronization - A Reference Model for Multimedia Synchronization- Synchronization Specification - Case Studies Abstractions for Programming: Abstraction Levels -Libraries - System Software - Toolkits-Higher Programming Languages- Object-oriented Approaches. Multimedia Applications: Introduction - Media Preparation- Media Composition - Media Integration - Media Communication - Media Consumption - Media Entertainment		**CO4**
UNIT V	**Multimedia Tools**	**Periods** : **9**
Rich Internet Applications (RIAs) with Adobe Flash and Flex:Adobe Flash- Introduction, Flash Movie Development, Learning Flash with Hands-on Examples, Publish your flash movie, Creating special effects with Flash, Creating a website splash screen, action script, web sources. Adobe Flex 2- Introduction, Flex Platform Overview, Creating a Simple User Interface, Accessing XML data from your application, Interacting		**CO5**
with Server Side Applications, Customizing your User Interface, Creating Charts and Graphs, Connection Independent RIAs on the desktop -Adobe Integrated Runtime (AIR), Flex 3 Beta. Ajax- Enabled Rich Internet Application: Introduction, Traditional Web Applications Vs Ajax Applications, Rich Internet Application with Ajax, History of Ajax, Raw Ajax example using xml http request object, Using XML, Creating a full scale Ajax Enabled application, Dojo ToolKit		

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. R. Steinmettz and K. Nahrstedt, Multimedia: Computing, Communications and Applications, Prentice Hall, Fourth edition,2014.
2. Franklin F Kuo, J.Joaquin Garcia, Wolf gang Effelsberg, Multimedia Communications: Protocols and Applications, Prentice Hall Publications, First Edition,1997.
3. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, Addison Wesley Publications. Wiley; First edition,2016.
4. Tretola, Simon barber and Renaun Erickson, Professional Adobe Flex 2, Wrox Publisher, First edition 2007.
5. PaulJ.Deitel, HarveyM.Deitel, AJAX, Rich Internet Applications, and Web Development for Programmers, Prentice Hall; First edition , 2008.

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3						
CO2	2	2					
CO3	3						
CO4	2	2				2	
CO5	3	3				2	
Avg	2.6	1.4				0.8	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme**: M.C.A.**						
Semester: **Third**			Course Category Code:**PSE-3**			Semester Exam Type: **TY**			
Big Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ09	**Platform Technology**		3	-	-	3	40	60	100
Prerequisite	Object Oriented Programming Languages								
Course Outcome	**CO1**	Compare .Net framework architecture, features and run time environment with conventional programming paradigm				Understanding			
	CO2	Develop console, windows and web applications using C#.NET.				Creating			
	CO3	Apply object oriented features, multithreading and exception handling techniques in application development				Applying			
	CO4	Explain advanced concepts related to ADO.NET, Web Services, WCF and WPF in project development.				Understanding			
	CO5	Create the dynamic web application using ASP.NET with ADO.NET data access.				Creating			

UNIT I	**.Net Basics**	**Periods** :**9**
.Net Overview- Microsoft.Net, .Net Platform, .Net Framework design goals, .Net Framework Common Language Runtime- CLR environment, CLR executables, Metadata, Assemblies and Manifests, Intermediate Language, CTS and CLS, CLR Execution		**CO1**
UNIT II	**C# Fundamentals**	**Periods** :**9**
Overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, LINQ, String, String Builder, Structure, Enumerations, boxing and unboxing		**CO2** **CO3**
UNIT III	**Object Oriented Aspects of C#**	**Periods** :**9**
Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, event handling, lambdas, exception handling, Threading, C# best practices.		**CO2** **CO3**
UNIT IV	**Application Development on .Net**	**Periods** :**9**
Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, Dataset, typed dataset, Data Adapter, handling exceptions, validating controls, transactions, connection pooling, windows application configuration		**CO4**
UNIT V	**Web Based Application Development on .Net**	**Periods** :**9**
Introduction-HTML5, CSS3, Asp.net essentials-server controls-validation controls-cookies, bootstrap, Asp.net database programming		**CO4** **CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Thuan L. Thai, Hoang Lam, .NET Framework Essentials, Third Edition, Shroff, 2003
2. Herbert Schildt, The Complete Reference: C# 4.0, Tata McGraw Hill, 2012.
3. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson and Morgan Skinner, Professional C# 2012 and .NET 4.5, John Wiley & Sons Inc., 2012
4. Anne Boehm, Murach's ASP.NET 4.6 Web Programming with C#, Mike Murach & Associates Inc.; Sixth edition, 2016

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	2	2	1	2	1
CO2	2	3	-	2	2	2	1
CO3	2	3	-	2	1	2	1
CO4	2	3	-	2	2	2	2
CO5	3	3	1	2	2	2	3
Avg	2.4	3	1.5	2	1.6	2	1.6

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PSE -3**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ10	**Object Oriented Software Engineering**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome		Acquire skills to think about problems and their solutions using appropriate methods of analysis and design					Understanding		
		Understand Software Design Process, Produce appropriate System Design, object design of reusable Activities					Understanding, Creating		
		Apply different types of patterns for designing software					Applying		
		Apply skills relevant for Mapping Models to Code, Configuration and project Management					Applying		
UNIT I	**Requirements**						**Periods** : **9**		
Requirements Elicitation activities, Arena Case Study – Problem Statement, identifying actors , relationships scenarios and use case cases, refining use cases.							**CO4**		
UNIT II	**Analysis**						**Periods** : **9**		
Analysis concepts, activities, Identifying entity, boundary and control objects, modeling interaction among objects, reviewing and consolidating the analysis model, applying analysis concepts to Arena Case Study.							**CO1 CO2**		
UNIT III	**System Design**						**Periods** : **9**		
Identifying design goals, subsystems, mapping subsystems to processors and components, identifying and storing persistent data, access control, designing global control flow, identifying boundary conditions= applying design concepts to Arena Case Study.							**CO3 CO4**		
UNIT IV	**Object Design**						**Periods** : **9**		
Applying Abstract factory, command and observer patterns to Arena case study, Interface specification concepts, specification activities, identifying mission operations and specifying contracts in Arena Case Study.							**CO3 CO4**		
UNIT V	**Mapping models to code**						**Periods** : **9**		
Mapping concepts, transformations, refactoring, forward and reverse engineering, transformation principlesArena Case Study – Class, mapping associations to collections, mapping contracts to exceptions, mapping object model to data base schema.							**CO4**		
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		
Reference Books									

1. Bend Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, Third Edition, Pearson, 2013.
2. Roger Pressman, Software Engineering A Practitioner's Approach, Seventh edition, McGraw-Hill, 2017.
3. Craig Larman, Applying UML and Patterns, Third edition, Pearson, 2015.
4. Ivar Jacobson, Object Oriented Software Engineering: A Use Case Driven Approach, First edition, Pearson, 2002.
5. Timothy C. Lethbridge and Robert Laganiere, Object-Oriented Software Engineering, Practical software development using UML and Java,Second edition, McGraw-Hill, 2001

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	2					
CO2	3	3	2	2	2		
CO3	2	2	3	3	2	2	
CO4	2	2				2	
AVG	2.5	2.25	1.25	1.25	1	1	

Score : **3**-High; **2**-Medium;

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PSE -3**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ11	**Software Project Management and Quality Assurance**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Outline the tasks in software project management					Understanding		
	CO2	Apply the process of project management in delivering successful projects					Applying		
	CO3	Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities					Evaluating		
	CO4	Summarize the quality assurance					Understanding		
	CO5	Identify the risks management					Applying		

UNIT I		**Periods** : **9**
Introduction to Project Management: Project- Management- Programs Project Portfolio Management-The Role of the Project Manager -Project Manager Job Description - The Project Management Profession. Project Management and IT context: System View- Understanding Organizations-Stakeholder Management - Project Phases and the Project Life Cycle - The Context of Information Technology -Recent Trends Affecting Information Technology Project		**CO1**

UNIT II		**Periods** : **9**
The Project Management Process Groups: A Case Study - Project Management Process Groups -Mapping the Process Groups to the Knowledge Areas-Developing an IT Project Management Methodology - Case Study 1: JWD Consulting's Project Management Intranet Site Project (Predictive Approach) - Project Pre-Initiation and Initiation - Pre-Initiation Tasks - Initiating - Project Planning 100 Project Execution Project Monitoring and Controlling - Project Closing. Project Integration Management: Introduction to Project Integration Management- Strategic Planning and Project Selection - Directing and Managing Project Work -Monitoring and Controlling Project Work Performing Integrated Change - Closing Projects or Phases - Using Software to Assist in Project Integration Management.		**CO2**

UNIT III		**Periods** : **9**

Project Time Management: The Importance of Project Schedules - Planning Schedule Management Defining Activities - Estimating Activity Resources - Estimating Activity Durations - Developing the Schedule - controlling the schedule-using software. Project Cost Management: The Importance of Project Cost -Basic Principles of Cost Management - Planning Cost Management - Estimating -Determining the Budget - Controlling Costs -Using Project Management Software to Assist in Project Cost Management.	**CO3**
UNIT IV	**Periods**: **9**
Project Quality Management: The Importance of Project Quality Management - Definition of Project Quality Management- Planning Quality Management - Performing Quality Assurance - controlling Quality - Tools and Techniques for Quality Control - Modern Quality Management - Improving IT Project Quality - Using Software to Assist in Project Quality Management .	**CO4**
UNIT V	**Periods** : **9**
Software Quality Assurance and Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools. Project Risk Management : The Importance of Project Risk Management - Planning Risk ManagementCommon Sources of Risk on IT Projects - Identifying Risks - Performing Qualitative Risk - Simulation Sensitivity Analysis - Controlling Risks	**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Kathy Schwalbe, Information Technology Management, Seventh Edition, Cengage Learning, 2014.
2. Glenford J. Myers, Corey Sandler Tom Badgett, The Art of Software Testing, John wiley Sons, 2011.
3. Gopalaswamy Ramesh, Managing Global Software Projects: How to Lead Geographically Distributed Teams; Manage Processes and Use Quality Models. McGraw Hill Education, 2017..

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1		2				2	
CO2		2	2			3	
CO3		2	2			2	
CO4		2	3			3	
CO5		2	1			2	
Avg		2	1.6			2.4	

Score : **3**-High; **2**-Medium; **1**-Low

<table>
<tr><td colspan="3">Department: Computer Science and Engineering</td><td colspan="5">Programme: M.C.A.</td></tr>
<tr><td colspan="3">Semester: Third</td><td colspan="3">Course Category Code:PSE-3</td><td colspan="2">Semester Exam Type: TY</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">Course Name</td><td colspan="3">Periods / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td></td><td>CA</td><td>SE</td><td>TM</td></tr>
<tr><td>CAZ12</td><td colspan="2">User Interface Design</td><td>3</td><td>-</td><td>-</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td>Prerequisite</td><td colspan="8">-</td></tr>
<tr><td rowspan="5">Course Outcome</td><td>CO1</td><td colspan="5">Outline the importance of user interface</td><td colspan="2">Understanding</td></tr>
<tr><td>CO2</td><td colspan="5">Identify human characteristics and their interaction with computers</td><td colspan="2">Applying</td></tr>
<tr><td>CO3</td><td colspan="5">Design menus and websites with different navigation schemes</td><td colspan="2">Creating</td></tr>
<tr><td>CO4</td><td colspan="5">Develop window components and controls</td><td colspan="2">Creating</td></tr>
<tr><td>CO5</td><td colspan="5">Evaluate prototypes against International standards</td><td colspan="2">Evaluating</td></tr>
<tr><td>UNIT I</td><td colspan="5">User Interfaces significance and difficulties in designing good UI</td><td colspan="3">Periods : 9</td></tr>
<tr><td colspan="7">Importance of User Interface- Characteristics of Graphical and Web User Interfaces- The User Interface Design Process: Obstacles and Pitfalls in the Development Path- Usability</td><td colspan="2">CO1</td></tr>
<tr><td>UNIT II</td><td colspan="5">Human computer interaction characteristics</td><td colspan="3">Periods : 9</td></tr>
<tr><td colspan="7">Understanding How People Interact with Computers-Important Human Characteristics in Design Human Considerations in the Design of Business Systems- Human Interaction Speeds- Understand the Business Function</td><td colspan="2">CO2</td></tr>
<tr><td>UNIT III</td><td colspan="5">Screen-Menu Design and Navigation schemes</td><td colspan="3">Periods : 9</td></tr>
<tr><td colspan="7">Human Considerations in Interface and Screen Design Technological Considerations in Interface Design Examples of Screens-Develop System Menus -Structures – Functions Content- Formatting Phrasing the Menu -Selecting Menu Choices Navigation Schemes-Web Site Navigation- Kinds of Graphical Menus- Graphical Menu Examples</td><td colspan="2">CO3</td></tr>
<tr><td>UNIT IV</td><td colspan="5">Windows and screen-based control design</td><td colspan="3">Periods : 9</td></tr>
<tr><td colspan="7">Window Characteristics-Components of a Window -Window Presentation Styles Types of Windows Organizing Window Functions-The Web and the Browser - Selection of proper interaction input-output devices Selection of screen-based controls- Operable Controls Text Entry/Read-Only Controls Selection Controls Combination Entry/Selection Controls Other Operable Controls Custom Controls Presentation Controls Selecting the Proper Controls-Examples</td><td colspan="2">CO4</td></tr>
<tr><td>UNIT V</td><td colspan="5">Standardization and evaluation</td><td colspan="3">Periods : 9</td></tr>
<tr><td colspan="7">International Considerations-accessibility- Create Meaningful Graphics, Icons, and Images-Selection of colors- Organize and Layout Windows and Pages
Usability-prototypes-Kinds of tests-Developing and conducting a test</td><td colspan="2">CO5</td></tr>
<tr><td colspan="2">Lecture Periods: 45</td><td colspan="2">Tutorial Periods: -</td><td colspan="2">Practical Periods: -</td><td colspan="3">Total Periods: 45</td></tr>
<tr><td colspan="9">Reference Books</td></tr>
</table>

1. Wilbert O. Galitz, The Essential Guide to User Interface Design-An Introduction to GUI Design Principles and Techniques, Third Edition, Wiley publishing Inc.,2007.
2. Alan Cooper, The Essential Of User Interface Design, Wiley – Dream Tech Ltd., 2007.
3. Alan Cooper, Robert Reimann, and Dave Cron, The Essentials of Interaction Design, Wiley publishing Inc.,2007.
4. Jenifer Tidwell, Designing Interfaces, O'Reilly Media, 2011.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3						
CO2	3						
CO3	3	2		3		2	
CO4	3	3		2		3	
CO5	3	2		2	2	2	
Avg	3	1.4		1.4	0.4	1.4	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A**						
Semester**: Third**			Course Category Code:**PSE-4**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ13	**Machine Learning**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Explain basic concepts of Machine Learning					Remembering		
	CO2	Compare Bayesian decision theory and dimensionality reduction techniques					Analysing		
	CO3	Design the clustering techniques and their utilization in machine learning					Creating		
	CO4	Illustrate working principle of Multilayer perceptron and Hidden Markov Models					Understanding		
	CO5	Perceive the concepts of Reinforcement learning and deep learning.					Evaluating		

UNIT I	**Introduction To Machine Learning and Supervised Learning,**	**Periods** : **9**
Introduction: Define Machine Learning, Applications, Supervised Learning: Vapnik-Chervonekis (VC) Dimension, Probably Approximately Correct (PAC)Learning, Regression, Model selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm,		**CO1**
UNIT II	**Bayesian Decision Theory, Dimensionality Reduction**	**Periods** : **9**
Bayesian Decision Theory – Classification – Losses and Risks – Discriminant Functions, Association Rules. Introduction to Parametric methods and Multivariate methods. Dimensionality reduction: Subset selection – Principal component analysis –Factor analysis – Multidimensional scaling – Linear discriminate analysis-Canonical Correlation analysis		**CO2**
UNIT III	**Clustering, Non-Parametric Methods**	**Periods** : **9**
Clustering – Mixture densities – k-Means clustering – Expectation-Maximization algorithm – Spectral Clustering-Hierarchical clustering. Non-parametric methods – Nonparametric Density EstimationNonparametric Regression smoothing Models		**CO3**
UNIT IV	**Multilayer Perceptron's, Local models**	**Periods** : **9**
Multilayer Perceptron's: Perceptron – Training a perceptron-Back propagation algorithm, Local models – Competitive learning – Radial basis functions – Mixture of experts – Hidden Markov models –Discrete Markov processes – Evaluation problem – State sequence – Learning model parameters – Model selection in HMM.		**CO4**
UNIT V	**Reinforcement learning, Deep Learning**	**Periods** : **9**
Reinforcement learning: Temporal Difference Learning, Q Learning. Deep Learning: How to train Multiple hidden layers-Improving Training Convergence-Convolutional Layers.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

CO-PO Mapping

Reference Books

1. Ethem Alpaydin, Introduction to Machine Learning , MIT Press, Fourth Edition,2020 2. Kevin P.Murphy, Machine Learning – A Probabilistic Perspective, MIT Press 2016
3. T. Mitchell, Machine Learning, McGraw-Hill, 1997.

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	1	-	-	1	1	-
CO2	3	1	-	-	2	1	-
CO3	3	3	1	1	2	2	1
CO4	3	3	-	2	2	3	2
CO5	2	1	-	1	1	2	2
Avg	2.8	1.8	0.2	0.8	1.6	1.8	1

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code:**PSE-4**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ14	**Internet of Things**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Outline the Internet of Things and its hardware and software components					Undestanding		
	CO2	Extend the concepts of Interface I/O devices, sensors & communication modules					Understanding		
	CO3	Demonstrate Remote monitoring of data and control devices					Understanding		
	CO4	Explain how to store data in cloud and create web services					Applying		
	CO5	Design real life IoT based projects					Creating		

UNIT I	**Introduction to IoT**	**Periods** : **9**
Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.		**CO1**
UNIT II	**IoT Physical Devices and Endpoints**	**Periods** : **9**
Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. **Software Components**- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.		**CO2**
UNIT III	**IoT Logical Design**	**Periods** : **9**
IoT Design Methodology – Specifications – Logical Design using Python – Data types and structures – Control flow – Functions – Modules – IoT packages – JSON – XML – HTTPLib – URLlib – SMTPLib.		**CO3**
UNIT IV	**Cloud Storage Models**	**Periods** : **9**
WAMP – Autobahn for IOT, Xively Cloud, Django – RESTful Web API – Amazon Web services – EC2, Autoscaling, S3, RDS, DynamoDB, Kinesis – SkyNet IoT Messaging System		**CO4**
UNIT V	**IoT Case Studies**	**Periods** : **9**
IoT case studies based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

CO-PO Mapping

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, A Hands-on Approach, University Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Second Edition, Wiley, 2012
3. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press, 2017
4. Adrian McEwen, Hakin Cassimally, Designing the Internet of Thing, Wiley, 2015

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**
CO1	3						
CO2	2	2					
CO3	2	2		2		2	
CO4	3	3		2		2	2
CO5	2	3		2	2	2	1
Avg	2.4	2		1.2	0.4	1.2	0.6

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PSE -4**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ15	**Data Mining and Business Intelligence**		3	-	-	3	40	60	100
Prerequisite	Database Management Systems								
Course Outcome	**CO1**	Design applications related to Association rule mining algorithm					Creating		
	CO2	Analyze uses of different classification algorithms for better classification					Analysing		
	CO3	Correlate data mining with Business Intelligence					Applying		
	CO4	Apply various modeling techniques and business Intelligence methods to various situations					Applying		
	CO5	Decide on appropriate technique to be used in different contexts					Evaluating		

UNIT I	**Introduction to Data Mining and Preprocessing**	**Periods** : **9**
Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process-Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Data Mining Primitives, Query Language, Graphical User Interfaces, Architectures, Concept Description, Data Generalization, Characterizations, Class Comparisons, Descriptive Statistical Measures.		**CO1**
UNIT II	**Concept Description, Association Rule Mining**	**Periods** : **9**
Overview of concept description - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative		**CO2**
UNIT III	**Classification and Prediction**	**Periods** : **9**
Classification – Rule Mining - classification and prediction – Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression Introduction of tools such as DB Miner /WEKA/DTREG DM Tools.		**CO3**
UNIT IV	**Data Mining for Business Intelligence Applications**	**Periods** : **9**
Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists' Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders		**CO4**

CO-PO Mapping

UNIT V	Overview and concepts Data Warehousing and Business Intelligence		Periods : 9
Reporting and Analysing data, Raw data to valuable information Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.			CO5
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. J. Han and M. Kamber, Data Mining: Concepts and Techniques, Harcourt India /Morgan Kauffman, 2001
2. M. Kantardzic , Data mining: Concepts, models, methods and algorithms, Third Edition, John Wiley &Sons Inc. 2019.
3. M. Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education, 2003
4. G. Shmueli, N.R. Patel, P.C. Bruce, Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office, Wiley, 2010.
5. Paulraj Ponnian, Data Warehousing Fundamentals, John Willey, 2001.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	1	-	-	1	1	-
CO2	3	1	-	-	2	1	-
CO3	2	3	1	1	2	2	1
CO4	3	3	-	2	1	2	2
CO5	2	1	-	1	1	2	2
Avg	2.6	1.8	0.2	0.8	1.4	1.6	1

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PSE -4**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ16	**Digital Marketing**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Explain the overall concept and understanding of Digital Marketing					Understanding		
	CO2	Analyze the confluence of Marketing, operation and Human resource in real time delivery.					Analysing		
	CO3	Analyze the Digital Marketing Platforms like YouTube, Facebook, Twitter, Pinterest, etc					Analysing		
	CO4	Explain the basics of Search Engine Optimization (SEO) and Mobile Marketing					Understanding		
	CO5	List the various strategies involved in Marketing products and Services Digitally					Remembering		

UNIT I	**Introduction to Digital Marketing**	**Periods** : **9**
Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models		**CO1**
UNIT II	**Internet Marketing and Digital Marketing Mix**	**Periods** : **9**
Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC; Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, AdRanks, Creating Ad Campaigns, Campaign Report Generation Display marketing: - Types of Display Ads- Buying Models- Programmable Digital Marketing- Analytical Tools- YouTube marketing		**CO2**
UNIT III	**Social Media Marketing – Role of Influencer Marketing, Tools & Plan**	**Periods** : **9**
Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy. Facebook Marketing: Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools. Linkedin Marketing: - Importance of Linkedin Marketing, Framing Linkedin Strategy, Lead Generation through Linkedin, Content Strategy, Analytics and Targeting Twitter Marketing: - Twitter Marketing, framing content strategy, Twitter Advertising Campaigns. Instagram and Snapchat: - Digital Marketing Strategies through Instagram and Snapchat. Mobile Marketing: - Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising		**CO3**

Analytics. Introduction to social media metrics			
UNIT IV	**Introduction to SEO, SEM, Web Analytics, Mobile Marketing, Trends in Digital Advertising**	**Periods** : **9**	
Introduction and need for SEO: How to use Internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM Web Analytics: - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code. Trends in digital advertising			**CO4**
UNIT V	**Application**	**Periods** : **9**	
creating an advertising campaign through any form of digital marketing viz: Mobile Marketing, Twitter Marketing, Facebook Marketing, LinkedIn Marketing, Instagram or Snapchat Marketing. creating the			**CO5**
campaign, running the campaign, presenting the results of the campaign in terms of Lead Generation and / or sales and / or web analytics.			
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Seema Gupta, Digital Marketing, Mc-Graw Hill, First Edition, 2017
2. Puneet Singh Bhatia, Fundamentals of Digital Marketing, Pearson, First Edition, 2017
3. K. Ragavendra , Shruthi P, Digital Marketing, Himalaya Publishing House Pvt. Ltd., 2018
4. Nitin C.Kamat, Chinmay Nitin Kamat, Digital Social Media Marketing, Himalaya Publishing House Pvt. Ltd., 2018

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	2	2			2	
CO2	2	2	2			2	
CO3	3	2	2			2	
CO4	3	2				2	
CO5	3	2	2			2	
Avg	2.8	2	1.6			2	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code:**PSE-5**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ17	**Information Security**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Summarize the need for security, threats and various attacks					Understanding		
	CO2	Identify the risk management techniques and apply their knowledge in real time security monitoring and control					Applying		
	CO3	Develop a various approach for implementing the security and create awareness in an organization					Creating		
	CO4	Describe the concepts of law, ethics and compliance					Understanding		

UNIT I	**Introduction**	**Periods** : **9**
CNSS Security model, Components of an Information System, Need for Security- Threats and attacks, Compromise to intellectual property, Espionage, Forces of nature, Sabotage, Attacks due to Software development vulnerabilities, Attacks on web security, Attacks on database security, Social Engineering Attacks, Security in SDLC.		**CO1**
UNIT II	**Security Controls**	**Periods** : **9**
Identification and Authentication-, Authorization and Access Control, Auditing and Accountability, Cryptography-History, Modern Cryptographic Tools, Protecting Data at rest, in motion and in use, Physical Security controls – protecting people, data and equipment.		**CO2**
UNIT III	**Assessing for Security**	**Periods** : **9**
Vulnerability assessment, Security Assessment Tools, Risk Management-Identification, Assessment and Control, Penetration Testing.		**CO3**
UNIT IV	**Implementing Security**	**Periods** : **9**
Approaches to Information security implementation, Information security project management, Building security awareness with security training programs.		**CO4**
UNIT V	**Laws, Ethics and Compliance**	**Periods** : **9**
Laws and Ethics- Indian Laws, International Laws, Legal Bodies, Ethics, Code of ethics, Compliance types, maintaining compliance, Adopting frameworks for Compliance.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Jason Andress, Foundations of Information Security - A Straightforward Introduction, No Starch Press, 2019.
2. Michael E. Whitman and Herbert J. Mattord, Principles of Information security, Sixth Edition, Cengage Learning, 2018.
3. Jason Andress, The Basics of Information Security: Understanding the fundamentals of Information Security in Theory and Practice, Syngress, 2011.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	1	1	1	-	-	-	-
CO2	2	2	2	1	1	3	1
CO3	1	1	2	1	1	1	1
CO4	1	1	1	-	-	-	-
Avg	1.25	1.25	1.5	1	1	1	1

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code: **PSE -5**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ18	**Ethical Hacking**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Analyze information gathering techniques using Foot printing, scanning and enumeration (V&S)					Analysing		
	CO2	Asses different tools for such as sense post, big brother etc for foot printing, AngryIP, Nmap etc for scanning, and Dupmsec, pstools etc for enumeration V&C&S)					Evaluating		
	CO3	Evaluation of social engineering and system hacking methods (V&C&S)					Evaluating		

UNIT I	**Introduction to Computer Networks, Ethical Hacking**	**Periods** : **9**
Computer Networks :TCP, IP, ARP -**Ethical Hacking**: Importance of Security-Elements of Security-Phase of an Attack- Hacker Attacks –Hacktivism – Ethical Hackers – Computer Crimes and Implication.		**CO1**
UNIT II	**Footprinting**	**Periods** : **9**
Introduction – Information gathering methodology – Footprinting tools – WHOIS Tool- DNS Information tool – Locating the network range – E-mail spiders – Locating network activity, Geo Spider, Google Earth – Meta Search Engines.		**CO1** **CO2**
UNIT III	**Scanning**	**Periods** : **9**
Scanning: Introduction – Objectives of scanning – Scanning methodologies – Tools, Live system scanning, Port scanning, Banner Grabbing, Active stack fingerprinting, File extension concealment, Vulnerability scanning, Vulnerability scanning, Network mapping, Proxy, Anonymizer, spoofing tools. **Enumeration**: Introduction – Techniques – Procedures – Tools, Null session, User account, Null session countermeasure, SNMP, General Enumeration tools.		**CO3** **CO4**
UNIT IV	**Social Engineering**	**Periods** : **9**
: Social Engineering: Introduction- Human weakness –Types – Human based social Engineering – Computer based social Engineering – Threats and Defense – Countermeasures- Case studies on Impersonating in Facebook, MySpace and Orkut		**CO3**
UNIT V	**System Hacking**	**Periods** : **9**
Introduction – Cracking password – Password cracking websites – Instant PDF password remover - Password guessing Algorithms – Password cracking Tools – Countermeasure – Escalating Privileges- Executing Applications – Key loggers and spywares.		**CO3**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. EC- Council, Ethical Hacking and Countermeasures: Attack Phases, Cengage Learning, Second Edition, 2016
2. EC- Council, Ethical Hacking and Countermeasures: Threats and Defense Mechanisms, Cengage Learning, Second Edition, 2016.
3. Michael T. Simpson, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2012.
4. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2014

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	3	2	2	2	2	3
CO2	2	2	3	2	2	2	2
CO3	2	3	2	2	2	2	3
Avg	2	2.66	2.33	2	2	2	2.66

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code:**PSE-5**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ19	**Blockchain Technology**		3	-	-	3	40	60	100
Prerequisite	● Basic Knowledge on Distributed Computing, Bitcoin and Crypto currencies. ● Good mathematical background is necessary.								
Course Outcome	**CO1**	Explain the basic functioning of Blockchain for bitcoin					Understanding		
	CO2	Demonstrate the Ethereum Blockchain functional modules for a specific implementation					Understanding		
	CO3	Interpret the consensus algorithms used in Blockchain networks.					Understanding		
	CO4	Develop applications using Blockchain for real-life problems					Creating		

UNIT I	**Introduction to Blockchain**	**Periods**: **9**
Introduction - Behold the Dreamers - Paradigm Shift – Cypher punk - Community- The Gold Rush: Mining Bitcoin - Reaching Consensus-Mining Hardware - Start-up Stories -New Consensus-Foundations of Blockchain: Transaction Workflow -Simple Payment Verification - Blockchain Forks.		**CO1**

UNIT II	**Unpacking Ethereum**	**Periods**: **9**
Overview of Ethereum -Accounts in Ethereum - State, Storage, and Gas - Ethereum Virtual Machine- Solidity Programming Language - World Computer - Blockchain-as-a-Service - Decentralized Applications - Geth and Mist - Decentralized Organizations : Aragon Kernel -Identity Management -DAO/Company Walkthrough - Setting Up a DAO - Issuing Shares -.Fundraising and By laws.		**CO1 CO2 CO3**

UNIT III	**The DAO Hacked**	**Periods**: **9**
Introduction -The Team -The DAO -The ICO Highlights -The Hack -The Debate -The Split: ETH and ETC -Ethereum Tokens: High-Performance Computing -Tokens and Value Creation-Ethereum Computational Market - Golem Network - Application Registry - Transaction Framework - Supercomputing Organized by Network Mining - Buyer–Hub–Miner Interactions - Super global Operation System for Network Architecture -iEx.ec.		**CO2 CO3**

UNIT IV	**Blockchain in Science**	**Periods**: **9**
Reproducibility Crisis-Clinical Trials- Reputation System- Pharmaceutical Drug Tracking -Blockchain in Health Care: Payer–Providers–Patient Model -Workflow - Hot Switching - Waste Management: Capital One, Ark Invest, and Gem - Verifiable Data Audit - The Hyperledger Project: Current Status - Governance Fabric and Sawtooth. Decision Models: Need for Blockchain, Rapid Prototyping with Hyperledger Composer.		**CO3 CO4**

UNIT V	**Recent Developments in Blockchain**	**Periods**: **9**
EOS Blockchain -Delegated Proof-of-Stake - Parallel Execution -Scheduling - Chain Core - Ethereum Enterprise Alliance - zk-SNARKs - Review of Quorum- Ethereum Enterprise Roadmap.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Vikram Dhillon, David Metcalf, Max Hooper, Blockchain Enabled Applications, Understand the Blockchain Ecosystem and How to Make it Work for You, Apress, First Edition, 2017
2. Mark Gates, Blockchain, Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and future of money, Wise Fox Publishing, First edition, 2017.
3. Imran Bashir, Mastering Blockchain, Distributed ledger technology, decentralization and smart contracts explained, Packt Publishing Ltd., Second edition, 2018.
4. Kevin Werbach, The Blockchain and the New Architecture of Trust (Information policy), The MIT Press, 2018.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	1	-	-	1		
CO2	3	2	1	-	1		
CO3	2	3	1	-	1	2	
CO4	2	2	1	-	1	2	
Avg	2.25	2	.75	-	1	2	

Score : **3**-High; **2**-Medium; **1**-Low

Department: **Computer Science and Engineering**			Programme: **M.C.A.**						
Semester: **Third**			Course Category Code:**PSE-5**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CAZ20	**Cloud Computing**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.				Understanding			
	CO2	Apply the fundamental concepts in datacenters to understand the tradeoffs in power, Virtualization, efficiency and cost.				Applying			
	CO3	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing				Applying			
	CO4	Evaluate the various software Utility Application				Evaluating			
	CO5	Summarize various cloud security models				Understanding			

UNIT I	**Introduction**	**Periods** : **9**
Cloud computing at a glance-Historical Developments-Building cloud computing environments-Virtualization-Characteristics of virtualized environments-Taxonomy of virtualization techniques-Virtualization and cloud computing-Pros and cons of virtualization-Technology		**CO1**
UNIT II	**Cloud Computing Architecture**	**Periods** : **9**
Introduction-The cloud reference model-Types of clouds-Economics of the cloud-Open challenges-Aneka-Framework Overview-Anatomy of the Aneka container-Building Aneka clouds-Cloud programming and management		**CO2,CO3**
UNIT III	**Concurrent Computing**	**Periods** : **9**
Introducing parallelism for single-machine computation-Programming applications with threads-Multithreading with Aneka-Programming applications with Aneka threads- High-Throughput Computing-Task Computing-Task-based application models-Aneka task-based programming		**CO3**
UNIT IV	**Data Intensive Computing**	**Periods** : **9**
What is data-intensive computing-Technologies for data-intensive computing-Aneka Map Reduce programming		**CO4**
UNIT V	**Industrial Platforms and New Developments**	**Periods** : **9**
Amazon web services- Google AppEngine- Microsoft Azure- Cloud Applications- Scientific applicationsBusiness and consumer applications- Energy efficiency in clouds- Market-based management of cloudsFederated clouds/InterCloud		**CO5**

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Reference Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, McGraw Hill Education,2013
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publications, 2014.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	2			2		
CO2	2	2	2		2		
CO3	2	2	2		2	2	
CO4	2	2	2	2	2		
CO5	2	2	2	2	2		
Avg	2	2	1.6	.8	2		