



# **MCA Semester-I**



### MCA Semester-I Credit and Evaluation Scheme

Sr. No.	Subject Code	Name of the Subject	Teaching Hours / Week				Evaluation Scheme / Semester								
			Th	Tu	Pr	Credit Total	Theory					Practical (Marks)			Total
							Internal Exam		University Exam		Theory Total	Internal Practical/Viva Exam*	University Practical Exam	Practical Total	
							Marks	Hrs	Marks	Hrs					
							Marks	Hrs	Marks	Hrs					
1	MCA-101	Object Oriented Programming Using JAVA (ઓબ્જેક્ટ ઓરીએન્ટેડ પ્રોગ્રામીંગ યુઝીંગ જાવા)	3			3	40	2	60	2½	100				100
2	MCA-102	Data Structures (માહિતીની આંતરિક સંરચના અને ગોઠવણી)	4			4	40	2	60	2½	100				100
3	MCA-103	Python Programming (પાયથોન પ્રોગ્રામીંગ)	3			3	40	2	60	2½	100				100
4	MCA-104	Database Management System (ડેટાબેઝ મેનેજમેન્ટ સિસ્ટમ)	3			3	40	2	60	2½	100				100
5	MCA-105-PR	Lab based on MCA-101 Object Oriented Programming Using JAVA			4	2						40	60	100	100
6	MCA-106-PR	Lab based on MCA-102 Data Structures			4	2						40	60	100	100
7	MCA-107-PR	Lab based on MCA-103 Python Programming			4	2						40	60	100	100
8	MCA-108-PR	Lab based on MCA-104 Database Management System			2	1						40	60	100	100



9	COMPL-101	Gramjivan Padyatra (ଗ୍ରାମଜୀବନ ପଥଯାତ୍ରା)													100
10		Community Living (ସମ୍ମୁହାଣ୍ଡନ)				Grade					Grade				Grade
			13		14	20									



<b>MCA Semester-I</b>	<b>MCA-101</b>	<b>Object Oriented Programming using Java</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Fundamentals knowledge of Programming.		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. To enable students to learn various features of object-oriented technology and Language</li> <li>2. To understand the basic concepts and fundamentals of platform independent and object-oriented language</li> <li>3. To develop object-oriented programs using object-oriented mechanism and Java</li> <li>4. Demonstrate skills in writing programs using exception handling techniques and multithreading</li> <li>5. To understand streams</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Features supported by object-oriented programming paradigm and differentiate with other programming paradigm</p> <p>CO2. Creating class, identify objects, describe, and demonstrate encapsulation mechanism</p> <p>CO3. Classify objects, demonstrate inheritance and polymorphism, discuss need of interface</p> <p>CO4. Use and Create packages and classify types of packages</p> <p>CO5. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.</p> <p>CO6. Understanding Java Stream, demonstrate use of I/O package, reading and writing data, Serialization</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	2	1	2	2	2	2
CO2	3	3	3	2	1	2	2	2	2
CO3	3	3	3	2	1	2	2	2	2
CO4	3	3	3	2	1	2	2	2	2
CO5	2	3	3	2	1	2	2	2	2
CO6	2	3	3	2	1	2	2	2	2

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Seminar</li> <li>4. Presentation</li> <li>5. Assignments</li> </ol>
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Lecture with Break up	No of Hrs.
<p><b>Unit 1</b></p> <p><b>Introduction Object Oriented Programming and Java.</b>  Object Oriented Overview and Concepts: Need of object-oriented programming, Object Oriented Programming vs other Paradigms, Principles of Object-Oriented Programming: Class and Objects, Encapsulation, Abstraction, Inheritance, and Polymorphism  <b>Introduction to Java:</b> History, Features, Program Structure, Java Virtual Machine, JRE, and J2SE/ JDK  <b>Java Programming Constructs:</b> Variable, Data Types: Primitive, Object Reference, String, Array etc., Identifiers, Literals, Operators, Expressions, Precedence Rules and Associativity, Type Conversion: Casting, Boxing, And Unboxing  <b>Flow of Control:</b> Decision Making statements: if, if else, if elseif, switch, Loop statements: do while, while, for, for-each loop. break and continue</p>	08
<p><b>Unit 2</b></p> <p><b>Java Programming building blocks</b>  Class: Introduction and Definition, Declaration, class body.  Object: Introduction and Definition, Creating Objects, Declaring, Instantiating and Initializing an Object.  Methods: Declaration, Invocation &amp; Overloading.  Constructors: Declaration, Constructor Overloading, “this” Keyword. Class Variable and Methods. Access Specifiers, Access Modifiers. Command Line Arguments. Garbage Collection and Finalization</p>	08
<p><b>Unit 3</b></p> <p><b>Inheritance and Polymorphism</b>  Inheritance Basics: Types of Inheritance, Access Control  Method Overriding, ‘super’ keyword, ‘final’ keyword  Polymorphism: Types of polymorphism, Abstract Method, Abstract Class  <b>Interface and Package</b>  Interface: Declaration, need, Variables and methods in Interface, Extending Interface  Interface Vs Abstract Class, Polymorphism with Interface  <b>Package:</b> Creating, Using and Access Protection  Importing Package  Java.lang package: Object, Wrapper Classes, String, StringBuffer and StringBuilder Classes</p>	12



<b>Unit 4</b>	<b>17</b>
<b>Exception Handling</b> Exception and Error in Java Exception Types and Exception-Handling Techniques: try, catch, finally, throw. User-Defined Exception and throws Exception Encapsulation and Enrichment <b>Input/output &amp; Serialization</b> Java Streams: What is Stream, advantages, Types of Streams: Character and Byte Stream File Class Byte and Character Stream classes hierarchy Reading and Writing Data: Using Byte and Character Stream, User Input Serialization: need and serialize class. <b>Multi-Threading and Multi-Thread Programming</b> Introduction, Use of Multithread programming The Main Thread Java Thread Model Thread class and Runnable interface Thread priority Thread synchronization and Thread communication Deadlock	

<b>Assessment Methods:</b>
Internal Assessment:
1. Continuous Evaluation: Project, classroom participation and department activity participation – 20 marks 2. Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)
External Assessment: University Exam – 60 Marks

<b>Text &amp; Reference Books:</b>	
1	Herbert Schildt - Java the Complete Reference, McGraw Hill Education
2	E. Balaguruswamy, Programming with Java A Primer, Mc Graw Hill
3	Herbert Schildt, Dale Skrien, Java Fundamentals A comprehensive introduction McGraw Hill Education.
4	James Rumbaugh, Michael Blaha, Object-Oriented Modelling and Design, Publication - Phi.
<b>Web &amp; Other Study Resources:</b>	
UGC Swayam Portal(Swayam Central) , e-PGPathshala(e-PGPathshala (inflibnet.ac.in))	



<b>MCA Semester-I</b>	<b>MCA-102</b>	<b>Data Structures</b>	<b>Compulsory</b>
		<b>Credit : 04</b>	<b>Teaching Hours : 60</b>
<b>Prerequisites:</b>	Knowledge of programming languages like C, C++ etc.		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. To develop proficiency in the specification, representation and implementation of Data types and Data Structures</li> <li>2. To perform various operation like insert, update, search and sorting on various data structures</li> <li>3. To carry out the Analysis of various Algorithms for mainly Time and Space Complexity</li> <li>4. To get a good understanding of applications of various Non-Linear Data Structures</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Developing proficiency in the specification, representation and implementation of Data types and Data Structures</p> <p>CO2. Understand various operation like insert, update, search and sorting on various data structures</p> <p>CO3. Developing proficiency Analysis of various Algorithms for mainly Time and Space Complexity</p> <p>CO4. Understanding of applications of various Non-linear Data Structures like Tree and Graph and apply various algorithms.</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	1	1	2	2	3	2
CO2	3	3	3	2	1	2	2	3	2
CO3	3	3	3	1	1	1	2	3	3
CO4	3	3	3	2	2	1	2	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion,</li> <li>3. Assignment</li> <li>4. Presentation</li> <li>5. Seminar</li> </ol>
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Lecture with Break up	No of Hrs.
<b>Unit 1</b>  <b>Introduction to Data Structure and Linear Data Structure</b> Data Management concepts, Data types – primitive and non-primitive Performance Analysis and Measurement (Time and space analysis of algorithms- Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures. <b>Linear Data Structure:</b> <b>Array</b> - Single dimensional & its addressing function, Multidimensional: two & three dimensional, Row major & column major representation & addressing functions. <b>Stack</b> - Definition & Concept, Operations on stack, Applications of Stacks, Conversion from infix to postfix <b>Queue</b> - Definition & Concepts, Operations on queue, Types of queue, Circular queue, Applications of Stacks priority queues, Priority queue, Process queue <b>Linked Linear List</b> - Sequential & linked allocation, their advantages and disadvantages, Singly linked list and operations on it, Double linked list and operations on it, Circular linked list and operations on it, Applications of linked list Linked implementation of stack & queue.	15
<b>Unit 2</b>  <b>Non-Linear Data Structure</b> Binary Search tree - Definition and Concepts, Representation, Operation Like Traversals : inorder, preorder, postorder, Insertion and Deletion, Copy, Searching Sequential representation of binary tree. Some balanced tree mechanism without implementation - AVL tree, B tree, B+ Tree, Height Balance - Weight Balance	15
<b>Unit 3</b>  <b>Graph</b> - Matrix representation of graph, Adjacency matrix, Path matrix, WARSHALL'S algorithm, MINIMAL algorithm, Adjacency list representation of graph, Operations on Graph, Breadth First Search, Depth First Search <b>Multilinked structure</b> - Sparse matrix, Sequential & linked allocation of sparse matrix, Matrix addition using sparse matrix <b>Dynamic storage management</b> - Fixed block storage allocation, First-fit storage allocation	15



<b>Unit 4</b>	<b>15</b>
<b>Sorting and Searching</b> <b>Hashing techniques</b> - The symbol table, Hashing Functions, Collision Resolution Techniques <b>Sorting methods</b> - Bubble Sort, Insertion Sort, Quick sort (Partition Exchange sort), Radix sort, Heap sort, Performance comparison of sorting methods <b>Searching</b> - Linear (sequential Search), Binary Searching	

<b>Assessment Methods:</b>
Internal Assessment :
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Text &amp; Reference Books:</b>	
1	An introduction to Data Structures with applications By Tremblay & Sorenson Pub: Tata McGrawHill
2	Data Structures using C - By Aaron M. Tenenbaum Pub: PHI
3	Reema Thareja, Programming in C, BPB publication, Oxford Higher Education, 2015
4	Data Structures using C & C++ By Rajesh Shukla, Pub: Wiley, 2015
<b>Web &amp; Other Study Resources:</b>	
1	UGC Swayam Portal(Swayam Central), e-PGPathshala(e-PGPathshala (inlibnet.ac.in))
2	Virtual Lab by IIT Mumbai



<b>MCA Semester-I</b>	<b>MCA-103</b>	<b>Python Programming</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Fundamental knowledge of any programming language		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Develop the foundation in programming concepts and object-oriented programming (OOP) principles.</li> <li>2. Students can gain proficiency in the usage of Python and apply Python to solve various computational problems.</li> <li>3. The course covers how to develop web applications using frameworks like Django</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Developing a solid foundation in programming concepts such as variables, data types, control structures (loops and conditional statements), functions, and object-oriented programming (OOP) principles.</p> <p>CO2. Gaining proficiency in the syntax, semantics, and usage of Python, which is known for its simplicity and readability.</p> <p>CO3. Using Python for data handling tasks such as reading/writing files, manipulating data structures (lists, dictionaries, tuples),</p> <p>CO4. Learning how to apply Python to solve various computational problems, ranging from simple tasks to complex algorithms.</p> <p>CO5. Understanding how to develop Python applications, including desktop GUI applications, web applications using Django framework, and scripting tasks.</p> <p>CO6. Understanding software development lifecycle practices, debugging techniques, and writing clean, maintainable code.</p> <p>CO7. Providing a strong foundation for further specialization in areas such as data science, machine learning, web development, cybersecurity, and software engineering, which often build upon Python skills.</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	1	1	1	1	1	1	1
CO2	2	3	1	1	1	1	1	2	1
CO3	2	3	1	1	1	1	1	2	1
CO4	2	3	2	1	2	2	1	3	1
CO5	2	3	3	2	2	3	2	3	2
CO6	2	2	1	2	1	2	1	3	1
CO7	1	1	1	3	2	1	1	2	1

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Assignments</li> <li>5. Case study</li> </ol>
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Lectures with Breakup	No of Hrs.
<b>Unit 1</b>  <b>Getting Started with Python</b> Introduction to Python, Installation and execution, introduction to popular IDE, Basic Data Types, Variables and print statements, Numbers, Strings, <b>Various Operators</b> -Assignment, Arithmetic Comparison, Logical, Bitwise, Membership and Identity Operators <b>Compound Data Types- Lists, Dictionaries, Tuples, Sets,</b> <b>Control Structures</b> - If-elif-else Statement, <b>Loops</b> -While Loops, For Loops, Nested loops and loops modifiers, Continue, Break and Pass keywords.	<b>10</b>
<b>Unit 2</b>  <b>Functions, Modules, and Packages</b> Introduction to Function, built-in and User define function, Scoping, Global & Local Variables, Default Arguments, Recursion, Lambda Functions. Introduction to Modules, Package, Working with Higher Order Functions <b>Files and Regular Expression</b> File I/O, File Opening Modes, Text Processing, String Methods, File I/O Operations. Pattern Matching and Regular Expression, Querying Publication Data.	<b>12</b>
<b>Unit 3</b>  <b>Object Oriented Programming</b> Introduction to OOP in Python, Classes and Object, Constructor, Inheritance, Subclass, Overriding, Composition, Polymorphism, Iterables, Iterators and Generators, Closers and Decorators. <b>Error &amp; Exception Handling</b> Introduction to error & exception, Raising Exceptions, Exception Handling, Else and finally Clauses	<b>15</b>
<b>Unit 4</b>  <b>Python Web Application Framework</b> <b>Introduction to Python Web Application Framework:</b> Installing and running a framework, Creating and Running a Web Application, Parameter Passing with GET.	<b>8</b>



<b>Assessment Methods:</b>	
Internal Assessment :	
•	Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks
•	Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)
External Assessment : University Exam – 60 Marks	

<b>Text &amp; Reference Books:</b>	
1.	Python Programming, Rupesh Nasre, AICTE, Oct-2020.
2.	Object-Oriented Python, Irv Kalb, O'Reilly, January 2022.
3.	Python Object-Oriented Programming, Steven F. Lott, Dusty Phillips, Packt, Fourth Edition.
<b>E Books:</b>	
1.	Python Programming, Rupesh Nasre, (AICTE Publication), Oct-2020.
<b>Web Resource</b>	
1.	<a href="https://www.freecodecamp.org/news/the-python-handbook/">https://www.freecodecamp.org/news/the-python-handbook/</a>
2.	<a href="https://www.freecodecamp.org/learn/data-analysis-with-python/data-analysis-with-python-course/introduction-to-data-analysis">https://www.freecodecamp.org/learn/data-analysis-with-python/data-analysis-with-python-course/introduction-to-data-analysis</a>



<b>MCA Semester-I</b>	<b>MCA-104</b>	<b>Database Management System</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Knowledge of data storing using File and file system implementation.</li> <li>• Fundamental of mathematics (set &amp; relation).</li> </ul>		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand architecture of DBMS, Design database, table and attributes</li> <li>2. Normalization is important part for tables</li> <li>3. Concurrency problems and its solution</li> <li>4. Use knowledge practically in SQL</li> </ol>
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<b>Course Outcomes:</b>	<b>Upon completion of the course, students shall be able to</b> CO1. Understand database management system architecture CO2. Create and manage database with all integrity constraints CO3. Refine the scheme of database by applying normal forms CO4. Recover the database from failures from concurrency problems CO5. Create views, procedures and triggers on databases
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	2	2	2	1	3	1
CO2	2	2	3	2	2	2	1	2	2
CO3	2	2	3	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2
CO5	2	3	2	2	3	3	2	2	2

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Assignments</li> <li>5. Group discussion</li> </ol>
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<b>Lectures with Breakup</b>	<b>No of Hrs.</b>
<b>Unit 1</b>  <b>Architecture of DBMS</b> The Three Levels of the Architecture. The External Level, The Conceptual Level, The Internal Level, Mappings, The Database Administrator, The Database Management System, Candidate Keys, Primary Keys, Alternate Keys, Foreign Keys, ER Diagram	<b>15</b>
<b>Unit 2</b>  <b>Database table Normalization</b> Non-loss Decomposition and Functional Dependencies, First, Second, Third, Fourth and Fifth Normal Forms, Dependency Preservation, Boyce/Codd Normal Form.	<b>8</b>
<b>Unit 3</b>  <b>Two-Phase Commit, Concurrency Problems, Locking and Isolation</b> Two-Phase Commit, SOL Support, Three Concurrency Problems, Locking, The Three Concurrency Problems Revisited, Deadlock, Serializability, Level of Isolation, Intent Locking	<b>15</b>
<b>Unit 4</b>  <b>SQL</b> Database creation & management, Table creation and management, Query on tables (select, insert, delete, update statement), Triggers	<b>7</b>



<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>	
External Assessment : University Exam – 60 Marks	

<b>Text &amp; Reference Books:</b>	
1	An Introduction to Database Systems by C.J.Date, A. Kannan, S. Swamynathan Publisher Pearson, 8 <sup>th</sup> edition
2	An Introduction to Database Management System By - Bipin Desai, Publisher PHI, Edition second
3	Database System Concepts By - AviSilberschatz, Henry Korth, S.Sudarshan,PublisherMcGrow-Hill, Edition 5th.
<b>Web &amp; Other Study Resources:</b>	
	UGC Swayam Portal(Swayam Central), e-PGPathsala(e-PGPathshala (inlibnet.ac.in))



<b>MCA Semester-I</b>	<b>MCA-105-PR</b>	<b>Lab Based on MCA-101 Object Oriented Programming Using JAVA</b>	<b>Compulsory</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of OOPS concepts and logic		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation		

<b>MCA Semester-I</b>	<b>MCA-106-PR</b>	<b>Lab Based on MCA-102 Data Structures</b>	<b>Compulsory</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of data structure concepts and logic		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation		

<b>MCA Semester-I</b>	<b>MCA-107-PR</b>	<b>Lab Based on MCA-103 Python Programming</b>	<b>Compulsory</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of python libraries and logic		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation		

<b>MCA Semester-I</b>	<b>MCA-108-PR</b>	<b>Lab Based on MCA-104 Database Management System</b>	<b>Compulsory</b>
		<b>Credit : 01</b>	<b>Lab Hours : 30</b>
<b>Prerequisites:</b>	Fundamental knowledge of Database concepts and logic.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>● Continuous Evaluation: <ul style="list-style-type: none"> <li>○ Practical assignment &amp; Journal – 20 marks</li> </ul> </li> <li>● Subjective Evaluation : Practical Exam and Viva : Internal 1 and Internal 2 – 20 (15 + 5 ) Marks (Best of Two)</li> </ul>	
External Assessment : University Practical & viva Exam – 60 Marks (40 + 20)	



## **MCA Semester-II**



## MCA Semester-II Credit and Evaluation Scheme

Sr. No.	Subject Code	Elective	Name of the Subject	Teaching Hours / Week			Evaluation Scheme / Semester								
				Th	Pr	Credit Total	Theory				Practical (Marks)			Total	
							Internal Exam		University Exam		Theory Total	Internal Practical /Viva Exam*	University Practical Exam		Practical Total
						Marks	Hrs	Marks	Hrs						
1	MCA-201	Elective-I	Operating System (ચાલક પદ્ધતિની તંત્રચના)	3		3	40	2	60	2½	100				100
		Elective-II	Mobile Application Development (મોબાઈલ એપ્લિકેશન ડેવલપમેન્ટ)												
2	MCA-202		Web Technology (વેબ ટેકનોલોજી) -Lab Based		6	3	40	2	60	2½	100				100
3	MCA-203		Computer Network (કોમ્પ્યુટર આંતરજોડાણ વ્યવસ્થા)	4		4	40	2	60	2½	100				100
4	MCA-204		Software Design Pattern (GOF) (સોફ્ટવેર ડીઝાઇન પેટર્ન (GOF))	3		3	40	2	60	2½	100				100



5	MCA-205		Software Engineering (ସଫ୍ଟୱେର ଇଞ୍ଜିନିରିଂ)	3		3	40	2	60	2½	100				100
6	MCA-206-PR	Elective-I	Lab based on MCA-201-E1 Operating System		4	2						40	60	100	100
		Elective-II	Lab based on MCA-201-E2 Mobile Application Development												
7	MCA-207-PR		Lab based on MCA-204 Software Design Pattern (GOF)		4	2						40	60	100	100
8			Community Living (ସମ୍ମୁଖିତାପନ)			Grade					Grade				Grade
				13	14	20									



<b>MCA Semester-II</b>	<b>MCA-201</b>	<b>Operating System</b>	<b>Elective-I</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Knowledge of computer hardware</li> <li>• Basic operation of operating system</li> <li>• Basic data structure algorithms and programming</li> </ul>		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. This subject accomplishes file management, device management, and process &amp; resource management.</li> <li>2. Students get knowledge of hardware interface with software that can be run to handle all devices, resources primary storage and secondary storage.</li> <li>3. It also enables the students about process creation and management in the system with scheduling all on the processor and resource handling for a process.</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Understand file management, device management, and process &amp; resource management.</p> <p>CO2. Develop proficiency of hardware interface with software that can be run to handle all devices, resources primary storage and secondary storage.</p> <p>CO3. Understanding about process creation and management in the system with scheduling all on the processor and resource handling for a process</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	3	2	3	3
CO2	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	2	2	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Projects</li> <li>5. Group discussion</li> </ol>
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Lecture with Break up	No of Hrs.
<b>Unit 1</b>  <b>Introduction to Operating System and File Structure</b> General overview of the system, System Structure, User Perspective, Operating System Service, Assumptions about Hardware, Introduction to the kernel, Architecture of the Operating System, Introduction to the system concepts, Kernel Data Structures, System Administration, Internal Representation of Files, Structure of a Regular File, Directories, Conversion of a path name, Super Block, Creation of a new file, Allocation of Disk Blocks, Other File Types	15
<b>Unit 2</b>  <b>File System Calls and Process Sub System</b> System Calls for the File System (without algorithm) - Open, Read, Write, File and Record Locking, Close, File Creation, Change Directory and Change Root, Change Owner and Changing Mode, The structure process, Process states and transitions, Layout of system memory, The context of a process, Saving the context of a process, Manipulation of the process address space, Sleep	8
<b>Unit 3</b>  <b>Control of the process</b> Process Control, Process Creation, Signals, Process termination, Awaiting process termination, invoking other programs, the user ID of a process, Changing the size of a process, The shell, System Boot, The INIT process	15
<b>Unit 4</b>  <b>Process Scheduling and Memory Management</b> Process scheduling and time, Process scheduling, System calls for time, Memory Communication	7





<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>	
External Assessment : University Exam – 60 Marks	

<b>Text &amp; Reference Books:</b>	
1	The design of Unix Operating system, By Morris Bache, Pub: PHI
2	The C Odyse, Meeta Gandhi, Tilak Shetty, Rajiv Shah, Pub: BPB
3	Silberschatz's Operating System Concepts by Abraham Silberschatz , Peter B. Galvin, et al. Pub: Wiley, 2019
4	Unix Shell Programming by Yashavant Kanetkar, Pub: BPB publications, 2003
<b>Web &amp; Other Study Resources:</b>	
1	UGC Swayam Portal(Swayam Central), e-PGPathshala(e-PGPathshala (inlibnet.ac.in))



<b>MCA Semester-II</b>	<b>MCA-201</b>	<b>Mobile Application Development</b>	<b>Elective-II</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Knowledge of the Core Java Programming concepts is must.</li> <li>• Knowledge of database concepts is must.</li> </ul>		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand the process of developing software for the mobile</li> <li>2. Create mobile applications on the Android Platform</li> <li>3. Student will be able to develop Android user interfaces</li> <li>4. Create mobile applications involving data storage in SQLite database.</li> <li>5. Understand the Android API network, web, Telephony..</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Analyze and design the simple class and object modelling.</p> <p>CO2. Identify and understand the different issues of software architecture</p> <p>CO3. Identify the appropriate design patterns to solve the issues of software architecture</p> <p>CO4. Develop the design solutions using the creational, structural and the behavior patterns</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	2	2	1	2	2	2	1
CO2	2	2	2	1	1	2	2	2	1
CO3	2	3	2	2	1	2	2	2	1
CO4	3	3	2	2	1	2	2	2	2

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Group discussion</li> </ol>
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Lectures with Breakup	No of Hrs.
<b>Unit 1</b>  <b>Android Application Design Essentials</b> Anatomy of an Android applications, Application Context, Activities, Services, Intents <b>Android Application Design Essentials</b> Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions, Managing Application resources in a hierarchy, Working with different types of resources	15
<b>Unit 2</b>  <b>Android User Interface Design Essentials</b> User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation	8
<b>Unit 3</b>  <b>Using Common Android APIs</b> Using Android Data and Storage APIs, Managing data using SQLite, Webservice (SOAP and REST), REST Webservice creation and utilization of webservice in Android Application	7
<b>Unit 4</b>  <b>Using Common Android APIs</b> Sharing Data Between Applications with Content Providers, Android Networking APIs , Android Web APIs, Android Telephony APIs, Google MAP in Android application, Accessing Android's Hardware Sensors (orientation sensors, light sensors)	15

**Assessment Methods:****Internal Assessment :**

- Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks
- Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)

External Assessment : University Exam – 60 Marks

**Text & Reference Books:**

1.	Android Wireless Application Development by Lauren Darcey and Shane Conder, 3rd Edition, Pearson Education.
2.	Professional Android 2 Application Development by Reto Meier, Wiley India Pvt Ltd, 2011.
3.	Beginning Android by Mark L Murphy, Wiley India Pvt Ltd, 2009.
4.	Pro Android by Sayed Y Hashimi and Satya Komatineni, Wiley India Pvt Ltd, 2009.



<b>MCA Semester-II</b>	<b>MCA-202</b>	<b>Web Technology (Lab based)</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Laboratory Hours : 90</b>
<b>Prerequisites:</b>	Basic concepts of DHTML (HTML, CSS & JavaScript), Web server, Java programming, Database fundamental & SQL		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Enhance knowledge to manipulate and store data.</li> <li>2. Explain different components of dynamic web application (DOM, CSS, DHTML-client-side and Script and server-side scripting, XML).</li> <li>3. Explore and understand use of Java Server Programming</li> <li>4. Create dynamic web pages, using Servlets and JSP</li> <li>5. Make a reusable software component, using Java Bean.</li> <li>6. Create MVC Application using Servlet, JSP, Java Bean and POJO</li> <li>7. Acquire knowledge of XML, DTD, and XML Schema and their usefulness in web application.</li> <li>8. Students learn skills to develop real time applications</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <ol style="list-style-type: none"> <li>CO1. Students learn to access database through Java programs, using Java Database Connectivity (JDBC)</li> <li>CO2. Describe and distinguish the architecture of client-side and server-side web applications.</li> <li>CO3. Identify the tools needed to create Java based dynamic web applications.</li> <li>CO4. Install and Configure servlet-JSP Container/Engine Tomcat</li> <li>CO5. Understand Java web application architecture and web.xml file</li> <li>CO6. Configure and deploy servlet-JSP based web application into tomcat.</li> <li>CO7. Develop a dynamic webpage using Java server-side programming (Servlet and JSP)</li> <li>CO8. Make a reusable software component, using Java Bean</li> <li>CO9. Understand MVC Architecture and its advantages.</li> <li>CO10. Design and develop MVC based application</li> <li>CO11. Understand the use of XML, DTD and XML Schema</li> </ol>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	3	2	2	2	2	3	2
CO2	3	3	3	2	2	2	2	3	2
CO3	3	3	3	1	2	2	2	3	2
CO4	3	3	3	1	2	2	2	3	3
CO5	3	3	3	1	2	2	2	3	2
CO6	3	3	3	1	2	2	2	3	2
CO7	2	3	3	1	2	2	2	3	2
CO8	2	3	3	1	2	2	2	3	2
CO9	2	3	3	1	2	2	2	3	2
CO10	2	3	3	2	2	2	2	3	2
CO11	2	3	3	1	2	2	2	3	2

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Group discussion</li> <li>5. Case study</li> </ol>
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Lecture with Break up	No of Hrs.
<p><b>Unit 1</b></p> <p><b>Data manipulation and Store data, Web Concepts, DHTML and Java Editions</b></p> <p><b>Database Handling using JDBC:</b> Java Database Connectivity, Driver, Driver Types, Compare and advantages of drivers, DriverManager, Connection, Statement, Prepared Statement, Callable Statement, ResultSet, Result set metadata.</p> <p>Overview of the Internet, Web as a platform and its components. Form processing at the client side. DHTML and its components. Dynamic page using DOM, CSS, and Java Script.</p> <p>Introduction to Request – Response Architecture, Web application and HTTP Protocol, Tomcat application server and its structure, Java Web Application Architecture, Understanding HTTP Status Codes, HTTP Request and Response Headers, Overview of Java Editions.</p> <p><b>Tomcat – The Servlet-JSP Container/Engine:</b> Introduction, Installation, and configuration, Understanding the responsibility of Container/Engine. Create and deploy web application.</p>	<p><b>15</b></p>
<p><b>Unit 2</b></p> <p><b>Servlet API and Session Management</b></p> <p><b>Servlet Model:</b> Servlet: What and why? Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor, Comparison with existing technologies, Servlet Interface, Servlet Context and Servlet Config interface, Generic Servlet, Http Servlet, Steps to create a Java web application in Tomcat, Handling Client Request- Reading Request Headers, reading request data in Servlet and Generate dynamic content/response. Request Redirection and Dispatching, Servlet- catch form data sent from client, process it, and store it on database. JDBC (Java Database Connectivity) and how it can be used within servlet.</p> <p><b>Session Tracking and Management:</b> Session Tracking: What and Why? Understanding Session Timeout and Session Tracking - Hidden Form Field, URL Rewriting, Cookies, HTTP Session Cookies: Create Cookie, remember user data, Deleting Cookies, Sending and Receiving Cookies, Differentiating Session Cookies from Persistent Cookies, Using Cookies to Remember User Preferences. Session Tracking and Management: Session Tracking using HTTP Session APIs, Encoding URLs, Sent to the Client and accumulating a List of User Data.</p>	<p><b>30</b></p>



<p><b>Unit 3</b></p> <p><b>Java Server Pages (JSP)</b>  Compare Servlet and JSP, Overview of JSP, Advantages of JSP, JSP Comment, Life Cycle of JSP page, JSP API, JSP Expression, JSP Scriptlet, JSP Declaration, JSP Directives, JSP Standard Action, JSP implicit Objects, JSP Directive, JSP Scripting elements, JSP Action Elements: jsp:forward, jsp:include, jsp:useBean, jsp:setProperty &amp; jsp:getProperty, Java Bean and JSP Communication, Exception Handling, JSP Session and Cookies Handling, JSP Session Tracking, JSP- catch form data sent from client, process it, and store it on database.</p> <p><b>Model-View-Controller (MVC) Application Design with Servlet-JSP:</b>  Introduction, MVC pattern Layer: Model, View, and Controller. Role of Servlet and JSP in MVC. Role and responsibility of Model, View, and Controller in MVC, Advantages of MVC. Role of Servlet, JSP, Java bean, and POJO in MVC.</p>	<p><b>35</b></p>
<p><b>Unit 4</b></p> <p><b>XML Technology</b>  <b>Extensible Markup Language (XML):</b>  Introduction and Overview, XML, Understanding the purpose and difference of HTML and XML, History and application of XML, XML Syntax, XML Document Structure and Building Blocks of XML Documents, XML Parsers, Well-formed and valid XML Documents, XML Namespace, Understanding DOM, Types of Elements</p> <p><b>Document Type Definition (DTD):</b> Introduction to DTD, Purpose of DTD, Create Internal and External DTD, referencing a DTD in an XML Document, defining building blocks of XML documents - Elements, Attributes, Entities, PCDATA, CTADA, Declaring Elements, Attributes and Entity.</p> <p><b>XML Schema: Introduction to XML Schema:</b> Purpose of XML Schema, Advantages of XML Schema, Comparison with DTD, Understanding Why XML Schema is better than DTD, Create XML Schema Document (.XSD), Referencing a Schema in an XML Document, defining building blocks of XML documents using Schema, XML Schema Data Types, Understanding use of Restriction, Occurrence, and Indicators with examples.</p>	<p><b>10</b></p>





<b>Assessment Methods:</b>	
Internal Assessment :	
	<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks	

<b>Textbooks &amp; Reference Books:</b>	
1	“Java Servlet Programming”, by Jason Hunter, William Crawford, O’Reily Publication
2	“Head First Servlets and JSP” by Bryan Basham, Kathy Sierra, Bert Bates, O’Reily Publication
3	“Professional XML”, by Mark Birbeck, Wrox Publication
4	“Core Servlets and Java Server Pages” Volume – 2”, Pearson Education
5	“Java Server Programming”, A Press Publication
5	“Pro JSP 2” by Simon Brown, Sam Dalton, Daniel Jepp, David Johnson, Sing Li, and Matt Raible, Apress Publication
6	“Web Technologies Black Book”, Dreamtech Press, Edition 2010
7	“Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script”, by Ivan Bayross, BPB Publications, Revised Edition
<b>Web &amp; Other Study Resources:</b>	
1	<b>Apache Tomcat</b> <a href="http://tomcat.apache.org">http://tomcat.apache.org</a>



<b>MCA Semester-II</b>	<b>MCA-203</b>	<b>Computer Network</b>	<b>Compulsory</b>
		<b>Credit : 04</b>	<b>Teaching Hours : 60</b>
<b>Prerequisites:</b>	Basic knowledge of telecommunication and data communication system		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand computer network</li> <li>2. Gain knowledge of transmission media</li> <li>3. Understand network protocols and standards</li> <li>4. Understand to establish computer network</li> <li>5. Learn information security</li> </ol>
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<b>Course Outcomes:</b>	<b>Upon completion of the course, students shall be able to</b> CO1. Work with Data Communication, Architecture, Protocols and Standards CO2. Implement functions of OSI and TCP/IP Layers CO3. Configure Network using Topologies and Transmission Media CO4. Understand concepts of Flow Control, Routing, Addressing and Transport Protocols CO5. Work with Network and Information Security
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	3	3	3	3
CO2	2	3	2	3	2	3	3	3	3
CO3	2	3	2	3	2	3	3	3	3
CO4	2	2	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Tutorial</li> <li>4. Seminar</li> <li>5. Presentation</li> <li>6. Assignments</li> </ol>
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Lectures with Breakup	No of Hrs.
<b>Unit 1</b>  <b>Introduction</b> Need of Data Communication and Applications, Network Models, TCP/IP and OSI Layering Models <b>Physical Layer</b> Transmission Media, Wired and Wireless Physical Layer <b>Data Link Layer – Error Detection and Correction</b> Introduction and Duties of Data Link Layer, Types of Errors, Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission, Error Detection, Error Correction, Block Coding, Linear Block Codes, Cyclic Codes	15
<b>Unit 2</b>  <b>Data Link Layer – Data Link Control</b> Data Link Control and Protocols, Flow and Error Control and its mechanism, Noiseless and Noisy Channels, Bluetooth, Architecture, Applications, Profiles, Pairing Process <b>Network Layer</b> Introduction, Duties of Network Layer, Routing, Accounting, Global Machine Level addressing, Connection Oriented and Connectionless Forwarding, Forwarding Examples, Routing Algorithms, Distance Vector Routing, Link State Routing, Border Gateway Protocol, Congestion and its Control, IPv4 Addresses, Address Space, Notations, Classful Addressing, Classless Addressing, Subnetting and Supernetting, IPv6 Addresses, Structure, Address Space, ICMP	15
<b>Unit 3</b>  <b>Transport Layer</b> Introduction, Duties of Transport Layer, Multiplexing, Demultiplexing and Port Numbers, Service to other Layers, Transport Layer of the Internet, Process Level Addressing, End to End Solutions, Connection Management at the Transport Layer, Delayed Duplicates, Connection Establishment, Connection Release, Congestion Control, Detecting Congestion, Reacting to Congestion, Fast Recovery, Flow Control, Communication Primitives	15
<b>Unit 4</b>  <b>Application Layer</b> Introduction, Domain Name System, Domain Name Space, Registration Process, Name Servers, Resource Records, Mailing System, SMTP, POP3 and IMAP,	15



Webmail, SNMP, Network Protocol Analyzer, Wireshark and its Applications and Features <b>Information Security</b> Introduction to Network Security, Cryptography, Digital Signatures, Public Key Management, Authentication Protocol, Authentication based on Shared Secret Key, Information Security	
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<b>Assessment Methods:</b>
Internal Assessment : <ul style="list-style-type: none"> <li>Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Textbooks &amp; Reference Books:</b>	
1	Computer Network, Andrew S. Tanenbaum
2	Computer Network, Bhushan Trivedi
3	Introduction to Data Communication and Networking, Behrouz Forouzan
4	Computer Network, Natalia Olifer, Victor Olifer
5	Data and Computer Communication, William Stallings
<b>Web &amp; Other Study Resources:</b>	
	UGC Swayam Portal ( <a href="http://swayamcentral.in">Swayam Central</a> ), e-PG Pathshala ( <a href="http://e-pgpathshala.in">e-PG Pathshala</a> ), NPTEL ( <a href="http://nptel.ac.in">nptel.ac.in</a> ), inflibnet ( <a href="http://inflibnet.ac.in">inflibnet.ac.in</a> ),



<b>MCA Semester-II</b>	<b>MCA-204</b>	<b>Software Design Pattern (GOF)</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Basic concept of Object-oriented design and familiarity with programming language (Java, C++ or C#.NET).		

<b>Course Objectives:</b>	This course will familiarize students with all fundamental and advance techniques of Object-Oriented Analysis design and modeling. ssuding GoF design patterns equips students with advanced software design skills, enhances their problem-solving abilities, and prepares them to design robust and maintainable software systems in professional environments.
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Gain a comprehensive knowledge of object-oriented analysis, design, modelling and understanding of design patterns, specifically the GoF design patterns.</p> <p>CO2. Learn to recognize common software design problems and apply appropriate design patterns to solve them effectively.</p> <p>CO3. Enhance the ability to design software systems that are flexible, scalable, maintainable, and reusable through the application of design patterns.</p> <p>CO4. Practice applying design patterns in real-world scenarios and case studies using Java or any other OOP to understand their practical use and benefits.</p> <p>CO5. Understand the principles behind design patterns, such as SOLID principles (Single Responsibility, Open-Closed, Liskov Substitution, Interface Segregation, Dependency Inversion), and how they relate to design pattern usage.</p> <p>CO6. Improve software quality by designing systems that are more modular, easier to maintain, and less prone to errors through the application of proven design patterns.</p> <p>CO7. Develop the ability to critically analyze software designs and evaluate when to apply specific design patterns based on trade-offs, constraints, and requirements.</p> <p>CO8. Enhance skills in communicating design decisions using design patterns effectively and documenting patterns used in the software architecture.</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	1	1	1	1	1	2	2
CO2	2	2	2	1	1	2	2	3	2
CO3	1	2	2	2	1	2	2	3	2
CO4	1	3	2	2	1	2	2	3	2
CO5	1	2	2	1	1	2	2	3	1
CO6	2	1	2	2	1	3	2	3	2
CO7	2	1	3	1	1	3	2	3	2
CO8	2	2	2	1	1	3	2	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Group discussion</li> <li>5. Case study</li> </ol>
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Lectures with Breakup	No of Hrs.
<b>Unit 1</b>  <b>Object Modeling</b> Introduction to Object Orientation Analysis and Design, Object Oriented Development and Themes, Importance of Modelling, principles of modeling, Objects, Classes, Class Diagrams, Values and Attributes, Operations and Methods, Link and Association concepts -Links and Associations, Multiplicity, Association and Names, Ordering, Association Classes, Qualified Association, Generalization and Inheritance, Aggregation ,Abstract classes, Generalization as extension and Restriction, Grouping Constructs, Sample Object modelling	10
<b>Unit 2</b>  <b>Design Patterns (GOF)</b> Introduction to design Pattern, Describing design Patterns, The catalog of Design Patterns, selecting design pattern and solve design problems <b>Creational Patterns</b> Abstract factory, Factory Method, Singleton, Prototype	15
<b>Unit 3</b>  <b>Structural Patterns</b> Adapter, Decorator, Façade, Proxy <b>Behavioral Patterns</b> Chain of Responsibility Pattern, State, Strategy, Observer	15
<b>Unit 4</b>  Case Study/Project - Framework Development	05



<b>Assessment Methods:</b>	
Internal Assessment :	
•	Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks
•	Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)
External Assessment : University Exam – 60 Marks	

<b>Text &amp; Reference Books:</b>	
1.	Object – Oriented Modeling and Design by James Rumbaugh, Michael Blaha
2.	Design Patterns Elements of Reusable Object-Oriented Software by Erich Gama, Richard Helm, Ralph Johnson, John Vlissides, Pearson Education
3.	Head First Object –Oriented Analysis & Design by Brett D. McLaughlin, Gary Pollice & David West, O'REILLY
4.	Head First Design Pattern by Eric Freeman & Elisabeth Freeman, O'REILLY
<b>Online Courses:</b>	
1.	<a href="https://www.edulib.in//userLib/subjectTopics/553">https://www.edulib.in//userLib/subjectTopics/553</a>





<b>MCA Semester-II</b>	<b>MCA-205</b>	<b>Software Engineering</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Basic concepts of System Analysis and Design		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand software development life cycles and various development models</li> <li>2. Gain knowledge regarding design paradigms</li> <li>3. Understand project management and quality management</li> <li>4. Understand fundamental concepts of software testing methods and issues related to software testing</li> <li>5. Identify various risks associated with software project.</li> </ol>
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<b>Course Outcomes:</b>	<b>Upon completion of the course, students shall be able to</b> CO1. Understand & implement different process models and prepare SRS CO2. Design software CO3. Test software effectively CO4. Understand & implement project management concepts CO5. Understand & implement quality management concepts CO6. Understand software measuring techniques
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	3	1	1	3	2	3	2
CO2	3	1	3	2	1	3	3	3	2
CO3	3	2	3	2	1	3	3	3	2
CO4	3	2	3	2	1	3	3	3	2
CO5	3	2	3	2	1	3	3	3	2
CO6	3	2	3	2	1	3	3	3	2



<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Seminar</li> <li>3. Presentation</li> <li>4. Group discussion</li> <li>5. Case study</li> </ol>
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<b>Lectures with Breakup</b>	<b>No of Hrs.</b>
<b>Unit 1</b>  <b>Introduction to Software and Software Engineering</b> The Evolving Role of Software, Software Engineering: A Layered Technology, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models, Component-Based Development, Agility and Agile Process model, Extreme Programming, <b>Requirement Analysis and Specification</b> Understanding the Requirement, Requirement Modelling, Requirement Specification (SRS), Requirement Analysis and Requirement Elicitation, Requirement Engineering	<b>15</b>
<b>Unit 2</b>  <b>Introduction to UML</b> UML Building Blocks, Modelling Views, Introduction to Use Case, Use Case Diagrams, State Diagrams, Sequence Diagrams, Activity Diagrams, Component Diagrams, Packages and Foundation	<b>10</b>
<b>Unit 3</b>  <b>Software Design</b> Design Concepts and Design Principal, Architectural Design, Component Level Design, User Interface Design, Web Application Design <b>Software Testing</b> Testing Strategies, Testing Techniques, Test Cases, Testing Conventional Applications, Testing Object Oriented Applications	<b>10</b>
<b>Unit 4</b>  <b>Software Project management</b>	<b>10</b>



Software Metrics : Process, Product and Project Metrics, Software Project Estimations, Software Project Planning, Project Scheduling & Tracking, Risk Analysis & Management <b>Software Quality management</b> Quality Concepts and Software Quality Assurance, Software Reviews (Formal Technical Reviews), Software Reliability, The Quality Standards : ISO 9000, CMM, Six Sigma for SE, SQA Plan	
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<b>Assessment Methods:</b>
Internal Assessment : <ul style="list-style-type: none"> <li>Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Textbooks &amp; Reference Books:</b>	
1	Software Engineering – A Practitioner’s Approach by Roger S. Pressman, McGraw-Hill International Edition, 7th Edition.
2	Software Engineering by Ian Sommerville, Prentice Hall India.
3	Software Engineering by Pankaj Jalote, Narosa Publication.
<b>Web &amp; Other Study Resources:</b>	
	UGC Swayam Portal( <a href="http://SwayamCentral.in">Swayam Central</a> ), e-PGPathshala( <a href="http://e-PGPathshala.inflibnet.ac.in">e-PGPathshala (inflibnet.ac.in)</a> )



<b>MCA Semester-II</b>	<b>MCA-206-PR-E1</b>	<b>Lab Based on MCA-201-E1 Operating System</b>	<b>Elective-I</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of Operating System concepts and any programming Language.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>MCA Semester-II</b>	<b>MCA-206-PR-E2</b>	<b>Lab Based on MCA-201-E2 Mobile Application Development</b>	<b>Elective-II</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of mobile application and Java programming Language.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>MCA Semester-II</b>	<b>MCA-207-PR</b>	<b>Lab Based on MCA-204 Software Design Pattern (GOF)</b>	<b>Compulsory</b>
		<b>Credit : 01</b>	<b>Lab Hours : 30</b>
<b>Prerequisites:</b>	Fundamental knowledge of Object Oriented concepts and any Object Oriented programming Language.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>Assessment Methods:</b>
Internal Assessment :
<ul style="list-style-type: none"> <li>Continuous Evaluation: <ul style="list-style-type: none"> <li>Practical assignment &amp; Journal – 20 marks</li> </ul> </li> <li>Subjective Evaluation : Practical Exam and Viva : Internal 1 and Internal 2 – 20 (15 + 5 ) Marks (Best of Two)</li> </ul>
External Assessment : University Practical & viva Exam – 60 Marks (40 + 20)



## **MCA Semester-III**



### MCA Semester-III Credit and Evaluation Scheme

Sr. No.	Subject Code	Elective	Name of the Subject	Teaching Hours / Week			Evaluation Scheme / Semester								
				Th	Pr	Credit Total	Theory				Practical (Marks)			Total	
							Internal Exam		University Exam		Theory Total	Internal Practical/ Viva Exam	University Practical Exam		Practical Total
						Marks	Hrs	Marks	Hrs						
1	MCA-301	Elective-I	Machine Learning & AI (મશીન લર્નિંગ એન્ડ એઆઇ)	3		3	40	2	60	2½	100				100
		Elective-II	Blockchain Technology (બ્લોકચેઇન ટેકનોલોજી)												100
2	MCA-302	Elective-I	Internet of Things (ઇન્ટરનેટ ઓફ થિંગ્સ)	3		3	40	2	60	2½	100				100
		Elective-II	Enterprise Resource Planning (એન્ટરપ્રાઇઝ રીસોર્સ પ્લાનીંગ)												100
3	MCA-303		Advanced Database Management System (એડવાન્સ્ડ ડેટાબેસ મેનેજમેન્ટ સિસ્ટમ)	4		4	40	2	60	2½	100				100
4	MCA-304		Internship			4	40		60						100
5	MCA-305-PR	Elective-I	Lab based on MCA-301-E1 Machine Learning		4	2						40	60	100	100



		Elective-II	Lab based on MCA-301-E2 Blockchain Technology												
6	MCA-306- PR	Elective-I	Lab based on MCA-302-E1 Internet of Things												
		Elective-II	Lab based on MCA-302-E2 Enterprise Resource Planning		4	2						40	60	100	100
7	MCA-307- PR		Lab based on MCA-303 Advanced Database Management System		4	2						40	60	100	100
8			COMMUNITY LIVING (ସମ୍ମୁହାୟତ୍ବ)			Grade					Grade				Grade
				10	12	20									8



<b>MCA Semester-III</b>	<b>MCA-301</b>	<b>Machine Learning &amp; AI</b>	<b>Elective-I</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Elementary Mathematics and statistics		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. This course introduces several fundamental concepts and popular machine learning algorithms with an introduction to artificial intelligence and deep learning</li> <li>2. Familiarize the students with data preprocessing, data cleaning, data exploration, data visualization learning algorithms, techniques and their applications</li> <li>3. The course will be accompanied by hands-on problem of moderate complexity solving with programming language</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Understand the meaning, purpose, scope, applications, and effects of Machine learning.</p> <p>CO2. Gain an in-depth theoretical and practical knowledge of exploratory data analysis.</p> <p>CO3. Understand the concepts of supervised and unsupervised learning models.</p> <p>CO4. Solve the classification and prediction problems using appropriate Machine learning algorithms and develop the ML model using Python.</p> <p>CO5. Evaluate and improve the model performance.</p> <p>CO6. Understand the concept of Artificial Neural Network and deep learning</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	1	2	3	1	1	2	1
CO2	2	3	2	2	3	2	2	3	2
CO3	2	1	2	2	3	1	1	2	2
CO4	1	3	3	3	3	2	2	3	2
CO5	1	2	3	2	3	1	1	3	3
CO6	1	1	1	3	3	1	1	2	2





<b>Teaching Pedagogy:</b>	1. Classroom Teaching 2. Seminar 3. Presentation 4. Case study
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<b>Lectures with Breakup</b>	<b>No of Hrs.</b>
<b>Unit 1</b>  Introduction to the fundamental concepts in machine learning and machine learning algorithms, Supervised Learning, Unsupervised learning and reinforcement learning. Introduction to data and its attributes, Data Cleansing & preprocessing. Issues of imbalanced data set & synthetic data generation techniques.	<b>10</b>
<b>Unit 2</b>  <b>Supervised Learning Algorithm</b> <b>K-Nearest Neighbours(K-NN)</b> Introduction to K-NN, Distance formula (Euclidean distance, hamming distance), Significance of k, find k closest neighbours, Bias–Variance Trade-off, vote for labels or calculate the mean, Advantages and disadvantages of K-NN <b>Naïve Bayes</b> Introduction to Naïve Bayes, Bayes Theorem & Assumption, The zero-frequency problem, Types of Naïve Bayes Classifier, Constructing a Naive Bayes Classifier. Pros and Cons of Naive Bayes, <b>Support Vector Machine</b> An Introduction SVM, Hyperplane, Support Vectors, Soft Margin SVM, Regularization Parameters, Significance of C, SVM Kernels & Kernel trick, Effect of Gamma, Introduction to Multiclass SVM.	<b>12</b>
<b>Unit 3</b>  <b>Linear Regression</b> Introduction to Simple Linear Regression, The Regression Equation, Fitted Values and Residuals, Least Squares, Prediction Versus Explanation (Profiling), Cost Function, Linear Regression using Gradient Descent Algorithm, Evaluating Metrics for Regression, and limitation of Linear Regression model. <b>Logistic Regression</b> Logistic Regression, Logistic Response Function and Logit, Logistic Regression and the GLM, Generalized Linear Models, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios, Linear and Logistic Regression: Similarities and Differences, Assessing the Model	<b>12</b>



<b>Evaluating Classification Models</b> Evaluating model performance, improving model performance, Confusion Matrix, The Rare Class Problem, Precision, Recall, and Specificity, ROC Curve, AUC. <b>Unsupervised learning Algorithm</b> <b>K-means clustering</b> Introduction to K-means clustering, Mathematical Representation, Expectation-Maximization, K-means clustering Algorithm, Popularity of K-means, Shortcomings Of K-means <b>Principle Component Analysis.</b> Feature Reduction/Dimensionality reduction	
<b>Unit 4</b>  <b>Foundation for AI</b> Introduction to AI and Application Area, AI Basic, Introduction to ANN (Perceptron and MLP), Introduction to Deep learning	<b>05</b>

<b>Assessment Methods:</b>
Internal Assessment : <ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Text &amp; Reference Books:</b>
1. Python Machine Learning by Sebastian Raschka, Pact Publication.
2. Practical Machine Learning by Sunil Gollapudi, Pact Publication.
3. Building-Machine-Learning-Systems-with-Python by Richert-Coelho, Pact Publication.
4. Scikit-learn: Machine learning in Python by Pedregosa Fabian, et al., Journal of Machine Learning Research 12. Oct (2011): 2825-2830.
5. Mastering Machine Learning Algorithm by Jason Brownlee.
<b>Web &amp; Other Study Resources:</b>
1. <a href="https://swayam.gov.in/nc_details/NPTEL">https://swayam.gov.in/nc_details/NPTEL</a>



<b>MCA Semester-III</b>	<b>MCA-301</b>	<b>Blockchain Technology</b>	<b>Elective-II</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Fundamental of data structure		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand how blockchain systems work.</li> <li>2. Securely interact with them.</li> <li>3. Design, build, and deploy smart contracts and distributed applications.</li> <li>4. Integrate ideas from blockchain technology into their own projects</li> </ol>
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<b>Course Outcomes:</b>	<b>Upon completion of the course, students shall be able to</b> CO1. Understand the concept of digital currency, virtual currency and crypto currency CO2. Blockchain concepts, benefits and limitations of blockchain technology CO3. Different blockchain methods of work CO4. Get knowledge about various case studies and types of Blockchain
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	2	2	1	2
CO2	2	2	2	2	2	2	2	2	2
CO3	1	2	2	2	3	2	2	1	3
CO4	1	3	2	2	3	2	2	2	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Tutorial</li> <li>4. Presentation</li> <li>5. Seminar</li> </ol>
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Lectures with Breakup	No of Hrs.
<b>Unit 1</b>  <b>Introduction to Blockchain</b> Introduction to Blockchain Technology. Idea of Centralized, Decentralized and Distributed system, Blockchain as a Public ledger. Problems with a centralized system. How Blockchain as a distributed ledger solve this problem. Advantage over conventional distributed database. Consensus models – concept. Consensus Algorithms – PoW, PoS, PBFT, DpoS, PoA, PoET .Comparative study of Consensus Algorithms	15
<b>Unit 2</b>  <b>BitCoin and Ether</b> Introduction to Bitcoin. Working of Bitcoin Blockchain. How Bitcoin achieve Decentralization (Distributed consensus) Bitcoin transactions, Bitcoin blocks, Bitcoin scripts, Bitcoin Network, Limitation & improvements. How to store and use Bitcoins – Hot and cold storage, online wallets and Exchanges, payments services, transaction fees, currency exchange market. Bitcoin Mining the tasks of bitcoin miners, Mining hardware, Energy consumption & Ecology, Mining pools, Mining incentives and strategies.	10
<b>Unit 3</b>  <b>Use of Blockchain</b> Types of Blockchain & its use cases and limitations. Blockchain in Financial services: Payments and Securities Trading – cross border payments, Steller protocol and network, Ripple protocol and network. Logistics. Supply chain.	5
<b>Unit 4</b>  <b>Digital Currency</b> Digital currency and its Introduction. Crypto currency. Virtual currency. E-wallets – types, examples and working. Cryptography: Hash function, Digital Signature – ECDSA, Memory Hard Algorithm, Zero Knowledge Proof. Permissionless Blockchain – Ethereum, Ethereum Blockchain and smart contracts, solidity, Dapps. Permissioned Blockchain - Introduction, Hyperledger, Fabric services, Fabric model & functions, Composer, Corda. Decentralized Application Platforms. Alternative Decentralized Solutions – Interplanetary File Systems (IPFS), Hashgraph	15



<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>	
External Assessment : University Exam – 60 Marks	

<b>Text &amp; Reference Books:</b>	
1	Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Princeton University Press, 2016.
2	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, Inc., 2014.
3	The Science of the Blockchain by Wattenhofer, Inverted Forest Publishing, 2016.
4	Blockchain: The Blockchain for Beginners Guide to Blockchain Technology and Leveraging Blockchain Programming by Josh Thompson, CreateSpace Publishing, 2016.
<b>Web &amp; Other Study Resources:</b>	
1	Mastering Ethereum by Antonopoulos, Andreas M. and Gavin Wood, O'Reilly Media, Inc., 2018. (Free draft available at <a href="https://github.com/ethereumbook/ethereumbook">https://github.com/ethereumbook/ethereumbook</a> )
2	Hyperledger Fabric, <a href="https://www.hyperledger.org/use/fabric">https://www.hyperledger.org/use/fabric</a>



<b>MCA Semester-III</b>	<b>MCA-302</b>	<b>Internet of Things</b>	<b>Elective-I</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Student should have basic knowledge of Embedded system, Networking concepts and protocols, Knowledge of computer programming		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand general concepts of Internet of Things (IoT)</li> <li>2. Familiarize the students to IoT Protocols and Communication Models</li> <li>3. Analyze various M2M and IoT architectures and Evaluate design issues in IoT applications.</li> <li>4. Describe IoT applications of various domain.</li> <li>5. Recognize various devices, sensors, and applications.</li> <li>6. Create IoT solutions using sensors, actuators, devices, and cloud.</li> <li>7. Build/Design of applications/solution that will communicate with IoT Hardware and software.</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Understand the concept of Internet of Things</p> <p>CO2. Explain the function blocks, IoT Protocols and Communication Models.</p> <p>CO3. Design and implement IoT solutions.</p> <p>CO4. Describe privacy, security, and design related challenges of IoT.</p> <p>CO5. Select proper sensor technology for IoT application.</p> <p>CO6. Implement interfacing of various sensors with Arduino/ESP-8266/32.</p> <p>CO7. Demonstrate the ability to transmit data wirelessly between different devices.</p> <p>CO8. Show an ability to upload/download sensor data on cloud and server</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	3	2	2	3	3
CO2	3	3	3	3	3	2	2	2	2
CO3	2	3	3	2	3	2	2	2	2
CO4	3	2	3	2	3	2	2	2	2
CO5	3	3	3	2	2	2	2	2	2
CO6	3	3	3	2	2	2	2	2	2
CO7	3	3	3	3	2	2	2	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Tutorial</li> <li>4. Project</li> <li>5. Seminar</li> </ol>
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Lecture with Break up	No of Hrs.
<b>Unit 1</b>  <b>Introduction</b> Definition and characteristics of Internet of Things (IoT), Importance of IoT Physical design of IoT: Hardware elements of IoT and their characteristics, IoT protocols - Link Layer, Network/Internet Layer, Transport Layer, Application Layer Logical Design of IoT: IoT functional blocks, IoT Communication Models – Request-Response, Publish-Subscribe, Push-Pull, IoT Communication APIs- REST-based communication APIs, WebSocket-based communication APIs, Micro services. Introduction to IoT Enabling Technology – Wireless Sensor Network, Cloud Computing, Big Data Analytics, Embedded Systems IoT Levels & Deployment Template	14
<b>Unit 2</b>  <b>IoT Application Domains:</b> Home automation, Smart Cities, Environment, Retail, Agriculture, Industry, Healthcare	6
<b>Unit 3</b>  <b>IoT, M2M and IoT Security and Privacy</b> Introduction, M2M, Differences and Similarities between M2M and IoT, Communication in IoT vs M2M, IoT Security & Privacy: Introduction, Security challenges & Requirements, Privacy, challenges & Requirements  <b>IoT Platforms Design Methodology</b> Purpose and requirement specification, Process Specification, Domain model Specification, Information model Specification, Service Specifications, IoT level Specification, Functional view Specification, Operational view Specification, Device and component integration, Application development	10
<b>Unit 4</b>  <b>Things in IoT</b> Introduction to microcontroller/MCU and SoC, Sensors & Actuators: IoT sensors, sensor types, sensor, characteristics, RFID, Usage & Applications, Actuators, Types of Actuators, Controlling IoT devices. <b>Arduino and EPS8266</b> Introduction to the Arduino and EPS8266, Basic building block, Components of Board, Interfacing with the Arduino for Data Transfer and Reading/writing,	15





<p>General Purpose GPIO PINs, Hardware Interfacing, Shields/Hats, Programming: Sensor, Actuator, Buzzer, LED etc., Arduino shields , Arduino programming and the Arduino IDE</p> <p><b>Introduction to EPS8266</b></p> <p>Wireless communication and programming with EPS8266, Communication with cloud , Wired/Wireless control and communications with the Arduino / Node MCU, IoT Physical Servers &amp; Cloud Offerings</p>	
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<b>Assessment Methods:</b>
<p>Internal Assessment :</p> <ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Textbooks &amp; Reference Books:</b>	
1	Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities Press, 2014 , 2014
2	Dr. Raj Kamal, INTERNET OF THINGS: Architecture and Design Principles, McGraw Hill India
4	Donald Norris, The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi, and Beaglebone Black, McGraw-Hill Education Pub.
5	Hoile C., et al.: Make – Raspberry Pi and AVR Projects, MakerMedia, 2014.
6	Margolis, M.: Arduino Cookbook, O'Reilly, 2nd Edition, 2011.
7	Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011



<b>MCA Semester-III</b>	<b>MCA-302</b>	<b>Enterprise Resource Planning</b>	<b>Elective-II</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Basic knowledge of telecommunication and data communication system		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Implement principles and approaches of ERP</li> <li>2. Design strategies for ERP implementation</li> <li>3. Can do Business Process Reengineering</li> <li>4. Can map business processes with ERP Software</li> <li>5. Work with ERP implementation</li> <li>6. Operate in real world business processes</li> <li>7. Develop future solutions to business needs.</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Apply principles and approaches of ERP</p> <p>CO2. Prepare strategies for ERP implementation</p> <p>CO3. Create reengineered business processes for successful ERP implementation</p> <p>CO4. Map business processes with ERP Software</p> <p>CO5. Work with ERP implementation</p> <p>CO6. Operate real world business process</p> <p>CO7. Provide future solutions to business needs</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	2	3	1	1	3	2	3	3
CO2	2	2	3	2	1	3	2	3	3
CO3	2	2	3	1	2	3	3	3	3
CO4	2	2	3	1	2	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3
CO6	2	2	3	3	3	3	3	3	3
CO7	2	2	2	3	2	3	3	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Tutorial</li> <li>4. Seminar</li> <li>5. Presentation</li> <li>6. Assignments</li> </ol>
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<b>Lectures with Breakup</b>	<b>No of Hrs.</b>
<b>Unit 1</b>  <b>About ERP</b> Introduction, Definition, Need for ERP, Evolution, Characteristics, Architecture, Applications, Benefits <b>ERP Functional Modules</b> Production Planning, Purchasing, Inventory Control, Sales, CRM, Marketing, Financial, Human Resource	<b>11</b>
<b>Unit 2</b>  <b>Business Process Reengineering</b> Business Process and Practice, Reengineering, Business Process Management <b>Supply Chain Management</b> Processes in Supply Chain, Components of Supply Chain, Handling Supply Chain, ERP and Supply Chain Management	<b>11</b>
<b>Unit 3</b>  <b>ERP Implementation</b> Planning Evaluation and Selection of ERP, ERP Implementation Life Cycle, Pre Evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation, Implementation Team Training, Testing, Implementation, Migration, End User Training, Post Implementation, Maintenance of ERP, Organizational and Industrial Impact, Success Factors of ERP Implementation, Key Success Factors, Failure Factors of ERP Implementation	<b>12</b>
<b>Unit 4</b>  <b>ERP Software</b> Working with ERP Software and Case Study, Architecture and Overview, Development Environment, New Application, Models And Basic Fields, About Security, User Interface, Views, Relations Between Models, Computed Fields, Working on Action, Constraints, Sprinkles, Inheritance, Interacting with Modules, QWeb, Coding Guidelines <b>Future Directions</b> Extended ERP Systems, New Trends in ERP	<b>11</b>



<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>	
External Assessment : University Exam – 60 Marks	

<b>Textbooks &amp; Reference Books:</b>	
1	Enterprise Resource Planning, Garg and Venkitakrishnan
2	Enterprise Resource Planning, Thomas and Michael
3	Enterprise Resource Planning, Alexis
<b>Web &amp; Other Study Resources:</b>	
	<a href="#">Odoo Documentation — Odoo 15.0 documentation</a>



<b>MCA Semester-III</b>	<b>MCA-303</b>	<b>Advanced Database Management System</b>	<b>Compulsory</b>
		<b>Credit : 04</b>	<b>Teaching Hours : 60</b>
<b>Prerequisites:</b>	<ul style="list-style-type: none"> <li>• Basic knowledge of Database and operating system</li> <li>• Relation database architecture</li> <li>• Should be aware of relational transactional and concurrency mechanism</li> </ul>		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. This subject is about advanced methods of database administration. It includes creation of database, managing storage.</li> <li>2. Physical memory allocation and concurrency problem of database system with reference to locking data.</li> <li>3. Third unit data handling and migration of data from one server to another by data pumping method.</li> <li>4. It also throws light on tuning of memory with various database components to change the structure and also Input-output with conventional and direct methods.</li> <li>5. Application tuning with reference to effective query writing, find the query execution plan and find the hit ratio for query processing using its objects.</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Implement advanced methods of database creation, management and administration. It includes creating all the objects with its storage criteria.</p> <p>CO2. Handle background Processes of database and its usage of physical memory allocation.</p> <p>CO3. Manage concurrency problem of database system with reference to locking data and concurrent processes by latching mechanism.</p> <p>CO4. Export and Import data and data transferring from third party software using loader.</p> <p>CO5. Implement database utilities like to find statistics of query execution with various parameters like CPU time, elapsed time, actual time etc. Students will also learn about various objects and their importance in query execution to find the cost of query using rule based analysis and cost based analysis.</p> <p>CO6. Perform memory tuning with reference to effective query writing and changing initialization parameters for memory structure and background processes. It will also help to learn I/O computation with reference to primary and secondary memory</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	2	2	3	1	3	3
CO2	3	3	3	3	2	3	1	3	3
CO3	3	3	3	3	2	2	3	3	3
CO4	3	3	3	2	2	2	2	3	2
CO5	2	2	3	3	3	3	3	3	3
CO6	2	2	3	3	3	3	3	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Projects</li> <li>4. Seminar</li> </ol>
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Lecture with Break up	No of Hrs.
<b>Unit 1</b>  <b>The Database Instance and Database Architecture</b> Defining the Instance, Creating the Instance, Understanding the Instance, Defining the Database, Different schema for system administration, Understanding the Components of the Database, Understanding Database Segments, Other Database Objects, Creating the Environment, Designing an Optimal Flexible Architecture, Creating Database	15
<b>Unit 2</b>  <b>Export-Import &amp; loading data from third party s/w, SQL with Programing</b> <b>IMPORT/EXPORT</b> - Export with Data pump utility, Import with Data pump utility, Loading data from third party database With various cases like truncation of data , conversion of data, filtering data with where clause, Different Loader Examples, Conventional and Direct Path Loading <b>Administering SQL commands</b> - Create, Alter, Truncate, Drop etc. DDL and DCL SQL commands, Tracing SQL Statements <b>SQL Programming</b> - Stored subprograms and packages, Defining Stored Subprograms. Building and Using Stored Programs	15
<b>Unit 3</b>  <b>Managing Storage and Lock, Supplied Oracle Database package</b> Managing Database Storage - Administering Database Objects, Understanding Database Fragmentation, Managing Rollback Segments, Identifying Storage Problems, Administering Growing Database, Integrity Management Locking – Implementing Locks, Analyzing lock table, Monitoring Locks on the System, Avoiding Locks & Possible Solutions, Implementing Locks with Latches	15





<b>Unit 4</b>	<b>15</b>
<b>Performance tuning fundamentals</b> Understanding need of tuning, Knowing the Tuning Principles, Tuning Goals, Using the Return on Investment Strategy, Revisiting Application Types, Using Diagnostic Tools. <b>Application Tuning</b> - Understanding the Optimizer, SQL Trace and derivation of statistics, Understanding execution plan <b>Tuning Memory</b> - UTLBSTAT/UTLESTAT, Tuning the Shared Pool, Tuning the Database Buffer Cache - Tuning the multithreaded Server (MTS), Tuning Locks, <b>Tuning I/O</b> – Tuning Table-spaces and Data-files, Tuning Blocks and Extents, Tuning Rollback Segments, Tuning Redo Logs	

<b>Assessment Methods:</b>
Internal Assessment :
<ul style="list-style-type: none"> <li>● Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>● Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>
External Assessment : University Exam – 60 Marks

<b>Text &amp; Reference Books:</b>	
1	Oracle 10g Performance Tuning by Rajeev Parida Pub: Firewall media
2	The power of Oracle 10g by Rajeev Parida Pub: Firewall Media
3	Database Administration: The Complete Guide to DBA Practices and Procedures 2nd Edition, Kindle Edition, by Craig S. Mullin
4	Oracle Complete Reference by Oracle press
5	Oracle DBA by Oracle press
<b>Web &amp; Other Study Resources:</b>	
1	Oracle Manual from <a href="http://www.oracle.org">www.oracle.org</a>



<b>MCA Semester-III</b>	<b>MCA-304</b>	<b>Internship</b>	<b>Compulsory</b>
		<b>Credit : 04</b>	<b>Teaching Hours : 60</b>
<b>Prerequisites:</b>	Concepts of System Analysis and Design & Software Engineering		

<b>Course Objectives:</b>	Internship during an MCA 3 <sup>rd</sup> semester aims to provide students with valuable practical experience, prepare them for the challenges of the professional world, and enhance their application development capability.
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p><b>CO1.</b> Practical Application of Knowledge**: Applying theoretical knowledge gained during the MCA program to real-world projects and tasks within the organization.</p> <p><b>CO2.</b> Professional Development**: Enhancing professional skills such as communication, teamwork, time management, and adaptability in a professional work environment.</p> <p><b>CO3.</b> Technical Skills Enhancement**: Gaining practical experience and improving skills in programming languages, software development methodologies, database management, networking, cybersecurity, or other specialized areas relevant to the internship role.</p> <p><b>CO4.</b> Problem-Solving Abilities**: Developing problem-solving skills by tackling real-world challenges and finding solutions under the guidance of experienced professionals.</p> <p><b>CO5.</b> Project Experience**: Contributing to projects from inception to completion, understanding project lifecycle phases, and gaining insights into project management practices.</p> <p><b>CO6.</b> Industry Exposure**: Gaining exposure to industry-specific practices, standards, and technologies relevant to the internship role and the organization.</p> <p><b>CO7.</b> Learning from Mentors**: Learning from experienced mentors and professionals in the field, benefiting from their guidance, feedback, and expertise.</p> <p><b>CO8.</b> Integration of Academic and Practical Knowledge**: Integrating academic knowledge with practical experience gained during the internship to foster a holistic understanding of computer applications and related fields.</p> <p><b>CO9.</b> Internship Report**: Producing a comprehensive internship report or project documentation summarizing the internship experience, achievements, and lessons learned.</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	3	2	2	2	3	3	2
CO2	2	3	3	2	2	3	3	3	2
CO3	3	3	3	2	2	2	2	3	2
CO4	2	3	3	2	2	3	2	3	2
CO5	2	2	2	2	2	2	2	3	2
CO6	2	3	3	2	2	3	3	3	2
CO7	2	2	2	2	2	3	2	3	2
CO8	2	3	3	2	2	3	2	3	2
CO9	3	3	3	3	2	2	3	3	2



<b>MCA Semester-III</b>	<b>MCA-305-PR-E1</b>	<b>Lab Based on MCA-301-E1 Machine Learning</b>	<b>Elective-I</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Knowledge of Python/R programming Language and Python ML libraries.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>MCA Semester-III</b>	<b>MCA-305-PR-E2</b>	<b>Lab Based on MCA-301-E2 Blockchain Technology</b>	<b>Elective-II</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Fundamental knowledge of OOPs and any programming Language.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>MCA Semester-III</b>	<b>MCA-306-PR-E1</b>	<b>Lab Based on MCA-302-E1 Internet of Things</b>	<b>Elective-I</b>
		<b>Credit : 01</b>	<b>Lab Hours : 30</b>
<b>Prerequisites:</b>	Fundamental knowledge of Object Oriented concepts and any Object Oriented programming Language.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>MCA Semester-III</b>	<b>MCA-306-PR-E2</b>	<b>Lab Based on MCA-302-E2 Enterprise Resource Planning</b>	<b>Elective-I</b>
		<b>Credit : 01</b>	<b>Lab Hours : 30</b>
<b>Prerequisites:</b>	Fundamental knowledge of Accounting and functional knowledge of business process.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		



<b>MCA Semester-III</b>	<b>MCA-307-PR</b>	<b>Lab Based on MCA-303 Advanced Database Management System</b>	<b>Compulsory</b>
		<b>Credit : 01</b>	<b>Lab Hours : 30</b>
<b>Prerequisites:</b>	Fundamental knowledge of DBMS and SQL.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>Assessment Methods:</b>
<p>Internal Assessment :</p> <ul style="list-style-type: none"> <li>● Continuous Evaluation: <ul style="list-style-type: none"> <li>○ Practical assignment &amp; Journal – 20 marks</li> </ul> </li> <li>● Subjective Evaluation : Practical Exam and Viva : Internal 1 and Internal 2 – 20 (15 + 5) Marks (Best of Two)</li> </ul>
External Assessment : University Practical & viva Exam – 60 Marks (40 + 20)



## **MCA Semester-IV**



### MCA Semester-IV Credit and Evaluation Scheme

Sr. No.	Subject Code	Elective	Name of the Subject	Teaching Hours / Week			Evaluation Scheme / Semester								
				Th	Pr	Credit Total	Theory				Practical (Marks)			Total	
							Internal Exam		University Exam		Total	Internal Practical/ Viva Exam	University Practical Exam		Practical Total
						Marks	Hrs	Marks	Hrs						
1	MCA-401		Internship (ઇન્ટર્નશીપ)			12	100		200		300				300
2	MCA-402		Cyber Security (સાઇબર સિક્યુરીટી)	3		3	40	2	60	2½	100				100
3	MCA-403		MOOC	3		3									
4	MCA-404-PR		Lab-based on MCA-402 Cyber Security		4	2						40	60	100	100



<b>MCA Semester-IV</b>	<b>MCA-401</b>	<b>Internship</b>	<b>Compulsory</b>
		<b>Credit : 12</b>	
<b>Prerequisites:</b>	Concepts of System Analysis and Design & Software Engineering		

<b>Course Objectives:</b>	Internship during an MCA program aims to provide students with valuable practical experience, prepare them for the challenges of the professional world, and enhance their employability upon graduation.
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p><b>CO1.</b> Practical Application of Knowledge**: Applying theoretical knowledge gained during the MCA program to real-world projects and tasks within the organization.</p> <p><b>CO2.</b> Professional Development**: Enhancing professional skills such as communication, teamwork, time management, and adaptability in a professional work environment.</p> <p><b>CO3.</b> Technical Skills Enhancement**: Gaining practical experience and improving skills in programming languages, software development methodologies, database management, networking, cybersecurity, or other specialized areas relevant to the internship role.</p> <p><b>CO4.</b> Problem-Solving Abilities**: Developing problem-solving skills by tackling real-world challenges and finding solutions under the guidance of experienced professionals.</p> <p><b>CO5.</b> Project Experience**: Contributing to projects from inception to completion, understanding project lifecycle phases, and gaining insights into project management practices.</p> <p><b>CO6.</b> Industry Exposure**: Gaining exposure to industry-specific practices, standards, and technologies relevant to the internship role and the organization.</p> <p><b>CO7.</b> Networking Opportunities**: Building professional relationships and expanding professional networks within the industry through interactions with colleagues, mentors, and industry experts.</p> <p><b>CO8.</b> Career Readiness**: Enhancing readiness for future career opportunities by gaining practical experience, building a professional portfolio, and understanding workplace dynamics and expectations.</p> <p><b>CO9.</b> Learning from Mentors**: Learning from experienced mentors and professionals in the field, benefiting from their guidance, feedback, and expertise.</p> <p><b>CO10.</b> Self-Reflection and Evaluation**: Reflecting on personal strengths, weaknesses, and career goals based on the internship experience, and identifying areas for further professional development.</p> <p><b>CO11.</b> Integration of Academic and Practical Knowledge**: Integrating academic knowledge with practical experience gained during the</p>
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	<p>internship to foster a holistic understanding of computer applications and related fields.</p> <p><b>CO12.</b> Final Internship Report**: Producing a comprehensive internship report or project documentation summarizing the internship experience, achievements, and lessons learned.</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	3	2	2	2	3	3	2
CO2	2	3	3	2	2	3	3	3	2
CO3	3	3	3	2	2	2	2	3	2
CO4	2	3	3	2	2	3	2	3	2
CO5	2	2	2	2	2	2	2	3	2
CO6	2	3	3	2	2	3	3	3	2
CO7	2	2	3	2	2	2	2	3	2
CO8	2	2	2	2	2	3	2	3	2
CO9	2	2	2	2	2	3	2	3	2
CO10	2	2	2	2	2	3	2	3	2
CO11	2	3	3	2	2	3	2	3	2
CO12	3	3	3	3	2	2	3	3	2



<b>MCA Semester-IV</b>	<b>MCA-402</b>	<b>Cyber Security</b>	<b>Compulsory</b>
		<b>Credit : 03</b>	<b>Teaching Hours : 45</b>
<b>Prerequisites:</b>	Programming experience in C/C++/Java/Python, Basics of web application, development, Computer Networks, Basics of Operating Systems		

<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Understand the concepts of Security, Cyber Security, and Cybercrimes.</li> <li>2. Identify types of Cybercrimes and Attacks</li> <li>3. Learn how the tools and methods that used by cyber criminals and protect systems from attackers.</li> <li>4. Learn about the importance of system security, configuration, and how to design and develop secure web applications.</li> <li>5. How to protect them self and ultimately society from such attacks.</li> <li>6. Acquiring knowledge of security risk related to data and information.</li> <li>7. Preparing for a platform to the students who wish to seek career or research in cyber security.</li> <li>8. Understand IT Act. and Legal Perspectives</li> </ol>
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<b>Course Outcomes:</b>	<p><b>Upon completion of the course, students shall be able to</b></p> <p>CO1. Understand and explain the concept of Security, Cyber Security and Cyber Crime.</p> <p>CO2. Explain the types of Cybercrimes and Cyber Criminals</p> <p>CO3. Understand the motive of Cyber Criminals</p> <p>CO4. Identify Cybercrime and Attacks</p> <p>CO5. Used to with various tools, techniques and methods that used by Cybercriminals</p> <p>CO6. Understand how to protect system from attackers and Acquiring knowledge of security risk related to data and information</p> <p>CO7. Understand and identify the common web vulnerability</p> <p>CO8. Design and develop secure web application.</p> <p>CO9. Protect themselves and society from cyber attack</p> <p>CO10. Understand ITA 2000 and Legal Perspectives</p>
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Course Outcomes	Expected Mapping with Program Outcomes (1-Weak Correlation; 2-Medium Correlation; 3 – Strong Correlation)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	3	2	3	2	2
CO2	3	2	2	3	3	2	3	2	2
CO3	3	3	3	3	3	2	3	2	2
CO4	3	3	3	3	3	2	3	2	2
CO5	3	3	2	2	2	2	2	2	2
CO6	3	3	3	2	2	2	2	2	2
CO7	2	3	3	2	2	2	2	3	3
CO8	3	3	3	2	2	2	3	3	3
CO9	2	2	2	2	2	3	3	3	3
CO10	2	2	2	2	3	2	3	3	3

<b>Teaching Pedagogy:</b>	<ol style="list-style-type: none"> <li>1. Classroom Teaching</li> <li>2. Group Discussion</li> <li>3. Case study</li> <li>4. Seminar</li> </ol>
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Lecture with Break up	No of Hrs.
<p><b>Unit 1</b></p> <p><b>Cyber Crime and The Legal Perspectives</b>  <b>Cyber Crimes:</b> Introduction, Cybercrime: Definition and Origins of the Word Cybercrime and Information Security. Evolution of Cyber Crimes, Cybercriminals, Classifications of Cybercrimes and Cyber Criminals. Hackers.</p> <p><b>The Legal Perspectives:</b> An Indian Perspective, Cybercrime and the Indian ITA 2000. Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.</p> <p><b>Cyberoffenses:</b> How Criminals Plan Them, Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing</p>	<p><b>7</b></p>
<p><b>Unit 2</b></p> <p><b>Tools and Methods Used in Cybercrime:</b> Introduction, Proxy Servers and Anonymizers, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS, Buffer Overflow, E-Mail Spoofing, Spamming, Cracking, Fraud and Forgery, Network Intrusions, Password Sniffing, Credit Card Frauds, Steganography, Phishing, Identity Theft (ID Theft)</p> <p><b>Security and Cyber Security</b>  Security and Cyber Security: Introduction, Security Concepts: Authentication, Authorization, Non-Repudiation, Integrity, Basic Cryptography, Encryption Techniques, Goal of Security – Confidentiality, Integrity, Availability, Authentication, Non-repudiation, Identification and Access Control: Password based authentication, Biometry, Access Token. Malicious Code and Classification of Malwares, Countermeasures to Malicious Code, Administrative Measures.</p>	<p><b>8</b></p>
<p><b>Unit 3</b></p> <p><b>Network Security:</b> Defense and Analysis Techniques / Security Measures and Protection. Common Network-based Attacks, Taxonomy of Attack, Systems Vulnerability Scanning.</p> <p><b>Network Layers, Protocols, and Types of Network Attacks:</b> Types of Layers 2 attacks- CAM table attack, MAC address spoofing attack, ARP Poisoning. Network and Transport Layer Attacks: IP, ICMP based attacks, UDP flood, TCP</p>	<p><b>15</b></p>



<p>SYN flood, Denial of Service Attack, Distributed DoS Attack, Zero-Day Attack, SSL - Architecture, SSL handshake protocol, TLS, HTTPS.</p> <p><b>Firewalls and Packet Filters:</b> Need of firewalls, characteristics of firewalls, Types of firewalls</p> <p><b>Cyber Crime Planning Phases:</b> 1) Reconnaissance-Active and Passive Attack. 2) Scanning and Scrutinizing Gathered Information- Port Scanning, Network Scanning and Vulnerability Scanning. 3) Attack/Exploit – Gaining and Maintaining System Access. 4) Post Attack Cleanup.</p>	
<p><b>Unit 4</b></p> <p><b>Exploitation and Web Hacking</b></p> <p><b>Intrusion Detection:</b> Component of intrusion detection framework, types, Function of IDS, strengths, and limitations. Exploitation: Basics of exploitation, Basics of Metasploit framework, Search, use, show payloads, show options, set options, exploit.</p> <p><b>Web Application Security:</b> Introduction to web server, HTTP, HTTPS, web application and web application stockholders/ users. IoT Security &amp; Privacy: Introduction, Security challenges &amp; Requirements, Privacy, challenges &amp; Requirements.</p> <p><b>Web Application Hacking:</b> The Basics of Web Hacking, Input Validation– Client and Server-Side Validations, Consequences of Weak Input Validations and Sanitization. Importance of Input Sanitization. Learn consequences of Misconfiguration in Web Server, Application, Operating System, and Security Misconfiguration, Insecure Account Policies, Verbose Error Messages. Common Web Vulnerabilities: Injection Vulnerabilities-SQL injection, LDAP Query, XPATH Queries, OS Command. Cross-site Scripting (XSS), Cross-site Request Forgery (CORS), Broken authentications and Session Management, Need of the Session Management, Session and Cookies Compromise and attacks, path traversal attacks. Countermeasures and fixes.</p>	<p><b>15</b></p>



<b>Assessment Methods:</b>	
Internal Assessment :	
<ul style="list-style-type: none"> <li>• Continuous Evaluation: Seminar, Case study, Classroom participation and Department activity participation – 20 marks</li> <li>• Subjective Evaluation : Theory Exam : Internal 1 and Internal 2 – 20 Marks (Best of Two)</li> </ul>	
External Assessment : University Exam – 60 Marks	

<b>Textbooks &amp; Reference Books:</b>	
1	Nina Godbole, Sunit Belapure, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley
2	The Basics of Web Hacking, “Tools and Techniques to attack the web, Josh Pauli, Syngress
3	Mike Shema, “Anti-Hacker Tool Kit (Indian Edition)”, Publication Mc Graw Hill.
4	Nina Godbole, Information Systems Security, Wiley India, New Delhi
5	William Stallings, “Cryptography and network Security, Principles and Practices”, Sixth Edition, Pearson
6	Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
7	Bruce Schneir, “Applied Cryptography: Protocols, Algorithms, and Source Code in C”, 20th Anniversary Edition, John Wiley & Sons
8	William Stallings, “Network Security Essentials Applications and Standards (5th Edition)”, Pearson
9	National Cyber Crime Reference Handbook - National Cyber Safety and Security Standards.
<b>List of Software / Learning Web References</b>	
1	<b>Kali Linux:</b> <a href="https://www.kali.org">https://www.kali.org</a>
2	<b>Windows OS:</b> Window 10/7/XP
3	<b>Metasploit:</b> <a href="https://www.metasploit.com">https://www.metasploit.com</a>
4	<b>Exploit DB:</b> <a href="https://www.exploit-db.com/">https://www.exploit-db.com/</a>
5	<b>Network Intrusion Detection &amp; Prevention System:</b> <a href="https://www.snort.org">https://www.snort.org</a>
6	<b>THC Hydra:</b> <a href="https://www.cyberpunk.rs/password-cracker-thc-hydra">https://www.cyberpunk.rs/password-cracker-thc-hydra</a>
7	<b>SqlMap:</b> <a href="https://sqlmap.org/">https://sqlmap.org/</a>
8	<b>VirtualBox:</b> <a href="https://www.virtualbox.org/">https://www.virtualbox.org/</a>
9	<b>Damn Vulnerable Web Application (DVWA):</b> <a href="https://dvwa.co.uk/">https://dvwa.co.uk/</a>



<b>MCA Semester-IV</b>	<b>MCA-403</b>	<b>MOOC</b>	<b>Compulsory</b>
		<b>Credit : 03/04</b>	<b>Teaching Hours : 45/60</b>
<b>Prerequisites:</b>			



<b>MCA Semester-IV</b>	<b>MCA-404-PR</b>	<b>Lab Based on MCA-402 Cyber Security</b>	<b>Compulsory</b>
		<b>Credit : 02</b>	<b>Lab Hours : 60</b>
<b>Prerequisites:</b>	Concept of Computer Network and security. Programming knowledge of C, C++, java, Python.		
<b>Objectives:</b>	Make theoretical concepts clearer through practical implementation.		

<b>Assessment Methods:</b>
Internal Assessment : <ul style="list-style-type: none"> <li>● Continuous Evaluation: <ul style="list-style-type: none"> <li>○ Practical assignment &amp; Journal – 20 marks</li> </ul> </li> <li>● Subjective Evaluation : Practical Exam and Viva : Internal 1 and Internal 2 – 20 (15 + 5 ) Marks (Best of Two)</li> </ul>
External Assessment : University Practical & viva Exam – 60 Marks (40 + 20)





## Program Outcomes

<b>Program Outcomes:</b>	<p>PO1. Basic and Discipline-specific knowledge - Equip students with a thorough understanding of fundamentals and core subjects of computer science.</p> <p>PO2. Practical Skills: Develop strong practical skills in programming, software development, and system design. This includes hands-on experience with various programming languages, development tools, and software platforms.</p> <p>PO3. Analytical and Problem-Solving Abilities: Foster strong analytical and problem-solving skills, enabling students to analyze complex problems and design efficient solutions using appropriate technologies and methodologies.</p> <p>PO4. Emerging Technologies: Keep students abreast of the latest developments and trends in the IT industry, including emerging technologies.</p> <p>PO5. Specialized Knowledge/Elective Subjects: Offer elective subjects allowing students to specialize in areas of interest like cybersecurity, artificial intelligence, data science, etc.</p> <p>PO6. Professional Competence: Prepare students for professional roles in the IT industry by developing their technical, managerial, and communication skills. This includes teamwork, project management, and leadership capabilities.</p> <p>PO7. Ethical and Social Responsibility: Instill a sense of ethical and social responsibility in students, emphasizing the importance of ethical practices, and data privacy. Apply appropriate technology in the context of society, sustainability, environment and ethical practices.</p> <p>PO8. Industry Readiness: Ensure that graduates are well-prepared for the job market, with the necessary technical and soft skills to excel in various roles such as software developers, systems analysts, IT consultants.</p> <p>PO9. Research and Innovation: Encourage a research-oriented mindset and innovation among students, motivating them to engage in research projects, contribute to scholarly publications, and develop innovative solutions to real-world problems.</p>
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## Program Specific Outcomes

<b>Program Specific Outcomes:</b>	<p>PSO1 <b>Advanced Knowledge of Computer Science:</b> Mastery of core concepts in computer science including algorithms, data structures, programming languages, computer architecture, operating systems, databases, networking, and software engineering principles.</p> <p>PSO2 <b>Proficiency in Software Development:</b> Ability to design, develop, test, and maintain software applications using contemporary programming languages, development tools, and methodologies.</p> <p>PSO3 <b>Specialization in Emerging Technologies:</b> Understanding and application of emerging technologies such as artificial intelligence, machine learning, cloud computing, internet of things (IoT), blockchain, and cybersecurity.</p> <p>PSO4 <b>Problem-Solving and Analytical Skills:</b> Development of analytical thinking and problem-solving skills to address complex issues in software development and IT systems.</p> <p>PSO5 <b>Management and Leadership Abilities:</b> Knowledge of IT project management principles, leadership skills, and ability to manage IT projects, teams, and resources effectively.</p> <p>PSO6 <b>Business Acumen:</b> Understanding the business context in which IT operates, including organizational behavior, strategic management, entrepreneurship, and the integration of IT solutions with business objectives.</p> <p>PSO7 <b>Ethics and Professional Responsibility:</b> Awareness of ethical issues in computing, understanding of professional responsibilities, and adherence to ethical standards in IT practices.</p> <p>PSO8 <b>Communication and Interpersonal Skills:</b> Effective communication skills for presenting technical information, collaborating with multidisciplinary teams, and interacting with clients and stakeholders.</p> <p>PSO9 <b>Research and Innovation:</b> Capability to conduct research in computer science, contribute to knowledge creation through innovative projects, and stay abreast of advancements in technology.</p> <p>PSO10 <b>Continuous Learning and Adaptability:</b> Commitment to lifelong learning, adaptation to technological changes, and readiness to acquire new skills and knowledge throughout their careers.</p> <p>PSO11 <b>Career Readiness and Employability:</b> Preparation for diverse career opportunities in software development, IT consulting, systems analysis, IT management, research and development, academia, entrepreneurship, and other related fields.</p>
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