V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Re-accredited with 'A' Grade (3rd Cycle) by NAAC

VIRUDHUNAGAR – 626 001

MASTER OF COMPUTER APPLICATIONS (8019)

Programme Structure - Allotment of Hours and Credits

For those who join in the Academic Year 2022-2023

Components	Semester				Total Number of Hours/ Credits
	I	II	III	IV	
Core Course	5(5)	5(5)	6(5)	6(5)	22(20)
Core Course	5(5)	5(5)	6(5)	-	16(15)
Core Course	5(5)	5(5)	-	-	10(10)
Core Practical	5(3)	5(3)	6(3)	6(3)	22(12)
Core Practical	5(3)	5(3)	6(3)	6(3)	22(12)
Discipline Specific Elective Course	5(5)	5(5)	-	-	10(10)
Non Major Elective Course	-	-	5(4)	-	5(4)
Online Course	-	-	1(1)	-	1(1)
Project	-	-	-	12(6)	12(6)
Total	**30(26)**	**30(26)**	**30(21)**	**30(17)**	**120(90)**
Extra Credit Course (Optional) - Department	**-**	**-**	0(2)	-	0(2)
Extra Credit Course (Optional) - MOOC	**-**	**-**	-	-	Limited to a maximum of 15 credits

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VIRUDHUNAGAR - 626 001

MASTER OF COMPUTER APPLICATIONS (M.C.A.)

Programme Code – 8019
PROGRAMME CONTENT
SEMESTER I

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-1	Data Structures	22PCAC11	5	5	3	40	60	100
2	Core Course-2	Operating Systems	22PCAC12	5	5	3	40	60	100
3	Core Course-3	Relational Database Management Systems	22PCAC13	5	5	3	40	60	100
4	Core Practical-1	Data Structures using C++ Lab	22PCAC11P	5	3	3	40	60	100
5	Core Practical-2	Open Source Technology Lab	22PCAC12P	5	3	3	40	60	100
6	DSEC-1	Data Communication and Networks / Computer Security / Business Intelligence	22PCAE11/ 22PCAE12/ 22PCAE13	5	5	3	40	60	100
Total				**30**	**26**				**600**

DSEC: Discipline Specific Elective Course

MASTER OF COMPUTER APPLICATIONS - SEMESTER II

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-4	Big Data Analytics	22PCAC21	5	5	3	40	60	100
2	Core Course-5	Advanced Java Programming	22PCAC22	5	5	3	40	60	100
3	Core Course-6	Internet of Things	22PCAC23	5	5	3	40	60	100
4	Core Practical-3	Data Analytics using R Lab	22PCAC21P	5	3	3	40	60	100
5	Core Practical-4	Advanced Java Programming Lab	22PCAC22P	5	3	3	40	60	100
6	DSEC-2	Compiler Design / Cloud Computing / Embedded systems	22PCAE21/ 22PCAE22/ 22PCAE23	5	5	3	40	60	100
Total				**30**	**26**				**600**

DSEC: Discipline Specific Elective Course

MASTER OF COMPUTER APPLICATIONS – SEMESTER III

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-7	Digital Image Processing	22PCAC31	6	5	3	40	60	100
2	Core Course-8	Machine Learning	22PCAC32	6	5	3	40	60	100
3	Core Practical-5	Digital Image Processing Lab	22PCAC31P	6	3	3	40	60	100
4	Core Practical-6	Python Programming Lab	22PCAC32P	6	3	3	40	60	100
5	NMEC	Web Technology	20PCAN31	5	4	3	40	60	100
6	Online Course	Practice for SET/NET – General Paper	20PGOL31	1	1	-	100	-	100
	Total			30	21				600

NMEC : Non Major Elective Course

EXTRA CREDIT COURSES OFFERED IN III SEMESTER

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Extra Credit Course	E-Commerce	22PCAO31	0	2	3	100	-	100

MASTER OF COMPUTER APPLICATIONS - SEMESTER IV

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-9	C# and .NET Programming	22PCAC41	6	5	3	40	60	100
2	Core Practical-7	C# and .NET Programming Lab	22PCAC41P	6	3	3	40	60	100
3	Core Practical-8	Mobile Application Development Lab	22PCAC42P	6	3	3	40	60	100
4	Core Project	Project - Research Methodology & Ethics	22PCAC41PR	12	6	3	60	40	100
Total				**30**	**17**				**400**

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
Core Course-1		Credits: 5	
Course Code	**DATA STRUCTURES**	Internal	External
22PCAC11		40	60

COURSE OUTCOMES

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

CO1	:	understand core concepts of linear data structures array, linked list, stack, queue and non-linear data structures trees, graphs, tables. [K2]
CO2	:	illustrate linear and non-linear data structures operations. [K3]
CO3	:	choose appropriate data structures to solve problems. [K3]
CO4	:	compare and analyze the linear and non-linear data structures with respect to various operations and complexity. [K4]
CO5	:	evaluate and prioritize the various data structures in terms of its operations. [K5]

UNIT I

Introduction and Overview: Definition - Concept of Data Structures – Overview of Data Structures – Implementation of Data Structures. **Arrays**: Definition – Terminology. **Linked Lists:** Definition. Singly Linked list: Representation of Linked List in Memory – Operations on a Single Linked List - Circular Linked list – Double Linked list: Operations on a Double Linked List. Circular Double Linked List: Operations on Circular Double Linked List.

(15 Hours)

UNIT II

Stacks: Definition – Representation of Stack: Array Representation of Stacks – Linked List Representation of Stacks. Operations on Stacks. Applications of stacks: Evaluation of arithmetic expression-Quick Sort. **Queues:** Definition - Representation of Queues: Representation of Queue using an Array – Representation of Queue using Linked List.

Various Queue Structures: Circular Queue – Dequeue – Priority Queue. Applications of Queues: Round Robin Algorithm.

(15 Hours)

UNIT III

Trees: Basic Terminology: Definition and Concepts: Binary Trees – Properties of Binary Tree. Representation of Binary Tree: Linear Representation of a Binary Tree- Linked Representation of Binary Tree - Physical Implementation of Binary Tree in Memory. Operations on Binary Tree: Insertion – Deletion – Traversal – Merging of Two Binary Trees. **Types of Binary trees**: Binary search tree. Representation of a Heap Tree – Operations on a Heap Tree: Insertion into a Heap Tree – Deletions of a node from Heap Tree .**Height Balanced Binary Tree**: Definition – AVL Rotations.

(15 Hours)

UNIT IV

Types of Binary Trees: **Heap Trees**: **Weight balanced Binary tree**: Basic terms – Weighted path length – Implementation of Huffman Tree – Application of Huffman Tree. **B-Trees:** B Tree indexing. Operation of B Tree: Searching, Inserting - B+ Tree Indexing.

(15 Hours)

UNIT V

Tables: Rectangular tables – Jagged tables – inverted tables – Hash tables: Hashing Techniques – Collision Resolution Techniques – Closed Hashing – Open Hashing – Comparison of Collision Resolution Technique. **Graphs**: Introduction – Graph Terminologies – **Representation of Graphs**: Set Representation – Linked Representation – Matrix Representation. **Operations on Graphs**: Operations on Matrix Representation of Graphs: Insertion – Deletion – Traversals.

(15 Hours)

TEXT BOOK

Debasis Samantha. (2009), *Classic Data Structures*, Second Edition, Prentice Hall of India Private Limited.

REFERENCE BOOKS

1. A. Chitra, D.T. Rajan. (2007), *Data Structures*, VNI Publication.

2. SartajSahni. (2005), *Data Structures, Algorithms and Applications in C++*, Second Edition, Silicon Press.

3. P.Rizwan Ahmed. (2014). *Programming in C++ and Data Structure*, 1st edition, Margham Publications.

4. Mark Allen Weiss. 15th Impression (2014), *Data Structures and Algorithm Analysis in C++,* 3rd edition, Pearson Publication, New Delhi.

5. Granville Barnett and Luca Del Tongo, *(e-Book)Data Structures and Algorithms: Annotated Reference with Examples*, First Edition, 2008.

6. https://nptel.ac.in/courses/106/106/106106145/

7. https://nptel.ac.in/courses/106/103/106103069/

8. https://nptel.ac.in/courses/106/102/106102064/

9. https://nptel.ac.in/courses/106/106/106106127/

Course Code **22PCAC11**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	-	-	-	H	-	-
CO2	H	M	H	-	-	-	-	-	L	-
CO3	H	M	-	H	H	M	-	M	-	L
CO4	H	-	M	M	M	M	M	L	-	-
CO5	M	-	L	L	H	H	M	-	-	-

N. Santhi

Head of the Department

N. Santhi

Course Designer

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
Core Course-2	**OPERATING SYSTEMS**	Credits: 5	
Course Code **22PCAC12**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : illustrate the basics of operating systems, classify process states, discuss different scheduling, outline the importance of memory hierarchy, and represent the file operations. [K2]

CO2 : identify the modes of I/O, race conditions, apply a suitable scheduling policy, model contiguous and non- contiguous memory allocation, and different access methods. [K3]

CO3 : identify the classes of OS, ways of managing memory hierarchy and plan for a suitable file organization method, manipulate Semaphores, choose appropriate deadlock handling method, and identify. [K3]

CO4 : examine how program execution is controlled, the Process Synchronization Problem, Deadlock Handling in UNIX, distinguish static and dynamic memory allocation and comment on Unix File System. [K4]

CO5 : assess different classes of OS, needs of semaphores, different deadlock handling methods, importance of paging and segmentation and disk scheduling methods. [K5]

UNIT I

Introduction: Abstract Views of an Operating System – Goals of an OS – Efficient Use – User Convenience – Noninterference - Operation of an OS – Program Management – Resource Management – Security and Protection - **The OS, the Computer, and User Programs** – Fundamental Principles of OS Operation – The Computer – The CPU – memory Management Unit (MMU) – Memory Hierarchy – Input/Output – Interrupts – OS Interaction

with the Computer and User Programs – Controlling Execution of Programs – Interrupt Servicing – System Calls – **Overview of Operating Systems** – Classes of OS – Efficiency, System performance, and User Service – Batch Processing System – Multiprogramming Systems – Time-Sharing Systems – Real-Time OS – Distributed OS – Android OS.

(15 Hours)

UNIT - II

Processes and Threads – processes and program – Implementing Processes – process states and state transitions – process context and the process control Block – Case Study of Processes in Unix – **Process Synchronization** – what is process synchronization? – Race Conditions – Critical Section – Classic Process Synchronization Problems – Semaphores – Case Studies of Process Synchronization in Unix.

(15 Hours)

UNIT - III

Scheduling – Scheduling Terminology and Concepts – Non-preemptive Scheduling Policies – Preemptive Scheduling Policies – Case Study – Scheduling in Unix – **Deadlocks** – What is a Deadlock? – Deadlocks in Resource Allocation – Handling Deadlocks – Deadlock Detecting and Resolution – Deadlock Prevention – Deadlock Prevention – Deadlock Prevention – Deadlock Avoidance – Deadlock Handling in Unix.

(15 Hours)

UNIT – IV

Message Passing - Overview of Message Passing – Implementing Message Passing – Case Study in Message Passing in Unix - **Memory Management** - Managing the Memory Hierarchy – Static and Dynamic Memory allocation – Contiguous memory allocation – noncontiguous memory allocation – paging – segmentation.

(15 Hours)

UNIT -V

File Systems – Files and File Operations – Fundamental File Organization and Access Methods – Directories – Case Study of Unix File System – **Implementation of File Operations –** Overview of I/O Organization – I/O Devices – Device Drivers – Disk Scheduling – Buffering of Records – Blocking of Records – Access Methods – Disk and File Cache - Case Studies in Unix, Linux and File Processing in Windows.

(15 Hours)

TEXT BOOKS

Dhananjay. M.Dhamdhere. (2013), *Operating Systems: A concept-Based Approach*, 3rd edition, Tata McGraw-Hill Education Pvt. Ltd.

REFERENCE BOOKS

1. Andrew S. Tanenbaum, Herbert Bos. (2014), *Modern Operating Systems*, 4th edition, Pearson Publication.

2. Abraham Silberschatz, Greg Gagne, Peter B.Galvin. (2011), *Operating System Concepts*, 8th edition, John Wiley & Sons.

3. William Stallings. (2018), *Operating Systems: Internals and Design Principles*, 9th edition, Prentice Hall.

4. Deitel. (2013), *Operating System*, 3rd edition, Pearson Education India.

5. Silber Schatz, Galvin, Gagne, *(e-Book)* Operating System Concepts, 8th Edition,

6. https://nptel.ac.in/courses/106/105/106105214/

Course Code **22PCAC12**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	M	-	L	-	-	-	-
CO2	M	H	M	M	M	L	-	M	-	L
CO3	-	M	H	-	M	L	-	-	-	-
CO4	M	-	-	M	H	M	M	M	-	-
CO5	H	M	H	H	H	H	-	H	-	-

N. Santhi

Head of the Department

M. Priyavani

Course Designer

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VIRUDHUNAGAR - 626 001

M.C.A.

(2022-23 onwards)

Semester I		Hours/Week: 5	
Core Course-3		Credits: 5	
Course Code **22PCAC13**	**RELATIONAL DATABASE MANAGEMENT SYSTEMS**	Internal 40	External 60

COURSE OUTCOMES

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

CO1 : Outline database system, relational model, formal query languages, atomic domains, functional dependency and normal forms, demonstrate transaction, concurrency, distributed and object based databases. [K2]

CO2 : identify database languages and database users, solve relation operations and concurrency problems, and apply protocols in distributed transactions.[K3]

CO3 : determine database system, relational model, formal query languages and functional dependency, solve various normal forms, utilize protocols to ensure serializability, apply object based concepts in SQL. [K3]

CO4 : analyze the database systems and improve its design by normalization, deadlock handling in distributed databases, protocols in handling replication in distributed databases, approaches to handle objects persistence. [K4]

CO5 : explain architecture of database systems, examine relation operations, interpret various normal forms, test for serializability of schedule, importance of distributed database and collection types and object orientation in object-based databases. [K5]

UNIT I

Introduction: Database System Applications – Purpose of Database Systems – View of Data – Database languages - Relational Databases - Database Design - Data Storage and Querying - Transaction Management - Database Architecture. **Relational Model:** Structure of Relational Databases – Database Schema - Keys - Schema Diagrams - Relational Query

Languages - Relational Operations. **Formal Relational Query Languages:** The relational algebra – The tuple relational calculus – The domain Relational Calculus.

(15 Hours)

UNIT II

Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition Using Functional Dependencies – Functional Dependency Theory – Algorithms for Decomposition - Decomposition Using Multivalued Dependencies – More Normal Forms - Database-Design Process - Modeling Temporal Data.

(15 Hours)

UNIT III

Transactions: Transaction Concept – A Simple Transaction Model - Storage Structure - Transaction Atomicity and Durability - Transaction Isolation - Serializability - Transaction Isolation and Atomicity - Transaction Isolation Levels - Implementation of Isolation Levels - Transactions as SQL Statements. **Concurrency Control**: Lock-Based Protocols – Deadlock Handling - Multiple Granularity - Timestamp-Based Protocols – Validation-Based protocols.

(15 Hours)

UNIT IV

Distributed Databases - Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Availability - Distributed Query Processing - Heterogeneous Distributed Databases - Cloud-Based Databases - Directory Systems.

(15 Hours)

UNIT V

Object Based Databases: Overview – Complex Data Types – Structured Types and Inheritance in SQL – Table Inheritance – Array and Multiset Types in SQL – Object-Identity and Reference Types in SQL – Implementing O-R Features - Persistent Programming Languages - Object-Relational Mapping - Object-Oriented versus Object-Relational.

(15 Hours)

TEXT BOOK

Abraham Silberschatz, Henry F. Korth, S.Sudarshan. (2011), *Database System Concepts*, Sixth Edition, Tata McGraw Hill International Edition.

REFERENCE BOOKS

1. Alexis Leon Mathews Leon. (2006), *Database Management Systems*, Vikas Publishing House Pvt. Ltd.

2. Raghu Ramakrishnan & Johannes Gehrke. (2000), *Database management systems*, 2nd edition, McGraw Hill International Edition.

3. Fred R.McFadden, Jeffery A.Hoffer and Marry B.Prescott. (2001), *Modern Database Management*, 5th edition, Pearson Education Asia.

4. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DATABASE%20MANAGEMENT%20SYSTEMS.pdf

5. https://nptel.ac.in/courses/106/105/106105175/

6. https://nptel.ac.in/courses/106/106/106106220/

7. https://nptel.ac.in/courses/106/106/106106093/

8. https://www.db-book.com/db6/slide-dir/

Course Code **22PCAC13**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	-	-	-	-	-	L	-	-
CO2	H	-	-	-	H	M	-	M	L	L
CO3	M	M	M	H	H	M	L	-	L	L
CO4	M	H	M	M	-	H	M	M	L	L
CO5	M	H	H	M	L	H	H	H	L	L

N. Santhi   R. Nagajyothi

Head of the Department   Course Designer

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
Core Practical-1	**DATA STRUCTURES USING C++ LAB**	Credits: 3	
Course Code **22PCAC11P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : illustrate linear and non-linear data structures. [K3]

CO2 : write programs for implementing the various operations of linear and non-linear data structures. [K3]

CO3 : key in and execute programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]

CO4 : explain the given program and answer questions related with that program. [K4]

CO5 : rewrite program to incorporate modification and justification of the desired result. [K5]

Write a C++ program to

1. Implement of Singly linked list.

2. Implement of Circular linked list.

3. Implement of Doubly linked list.

4. Implement of Stack data structure using array.

5. Implement of Stack data structure using linked list.

6. Implement of Queue data structure using array.

7. Implement of Queue data structure using linked list.

8. Implement of Stack applications.

9. Create and traverse binary tree.

10. Perform insertion and deletion operations on a binary tree.

11. Create and traverse binary search tree.

12. Perform insertion operation on a binary search tree.

13. Perform deletion operation on a binary search tree.

14. Create Expression tree.

15. Create Min heap data structures.

16. Create Max heap data structures.

17. Perform insertion and deletion on a heap.

18. Represent a graph data structure.

19. Traverse a graph using breath first search method.

20. Traverse a graph using depth first search method.

Course Code **22PCAC11P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	M	L	-	H	-	-
CO2	H	M	-	-	M	M	L	M	L	L
CO3	H	M	L	L	H	L	M	M	-	-
CO4	H	M	M	M	-	M	M	-	-	-
CO5	H	M	H	H	-	H	M	L	-	-

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
Core Practical-2	**OPEN SOURCE TECHNOLOGY LAB**	Credits: 3	
Course Code **22PCAC12P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1	:	identify the methods and process to use arrays, string, image, files, cookies, sessions and MYSQL database in web applications. [K3]
CO2	:	write programs implementing arrays, string, image, files, cookies, sessions and make connections with databases in web applications. [K3]
CO3	:	key-in the programs and test the programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]
CO4	:	explain the programs implemented using PHP and MYSQL and deduce the answers for any queries raised. [K4]
CO5	:	reconstruct the program to adapt the necessary modifications and justify the desired result. [K5]

List of programs

1. Write a program to perform string Manipulation.

2. Write a program to perform employee Pay bill Preparation using single inheritance.

3. Write a Program to validate registration form.

4. Write a Program to validate Form using CAPTCHA (Session).

5. Write a program to perform Array Operations.

6. Write a program to perform Exception Handling (User Defined Exceptions).

7. Write a program to perform file operations.

8. Write a program to concatenate two files.

9. Write a program to upload and download the files

10. Write a program to insert watermark to an image.

11. Write a program to apply various image filtering options.

12. Write a program to display page visitor count using session.

13. Write a program to creating and displaying cookie details.

14. Write a program to create MySQL database and display the record in table format

15. Write a program to drop MySQL database

16. Write a program to drop a MySQL table

17. Write a program to implement query builder (Library Database).

18. Write a program to perform inventory Details (Insert, Delete, Update, Display).

19. Write a program to perform Bank Transaction (Insert, Delete, Update, Display).

20. Write a program to prepare CRUD application for student details using Callable Statement.

21. Write a program to prepare CRUD application for student details using Prepare Statement.

22. Write a program to upload CSV file into MySQL data base

23. Write a program to populate database table field into dropdown list.

Course Code **22PCAC12P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	M	L	-	H	-	-
CO2	H	M	-	-	M	M	L	M	L	L
CO3	H	M	L	L	H	L	M	M	-	-
CO4	H	M	M	M	-	M	M	-	-	-
CO5	H	M	H	H	-	H	M	L	-	-

N. Santhi   B. Subashini

Head of the Department   Course Designer

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
DSEC-1	**DATA COMMUNICATION AND NETWORKS**	Credits: 5	
Course Code **22PCAE11**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : describe the basics of Data communication, OSI model, transmission media, function of network, transport layers & need for DNS. [K2]

CO2 : relate various reference models, guided and unguided transmission media and to know more about routing protocols and identify the QoS improving techniques at transport layer, various types of records of DNS. [K3]

CO3 : illustrate addressing at various layers, framing techniques, address mapping, congestion control and dynamic DNS. [K3]

CO4 : analyze the functions of each layer, compare various multiple access protocols, forwarding and routing, services provided by TCP and UDP, categorize components of email. [K4]

CO5 : evaluate the reasons for various addressing methods, flow & error control at datalink layer, prioritize various routing protocols, plan for better QoS and optimum file transfer mechanism. [K5]

UNIT I

Introduction: Data Communications – Networks– The Internet – Protocols and Standards.

Network Models: Layered Tasks – The OSI Model – Layers in the OSI model – TCP/IP Protocol Suite – Addressing.

(15 Hours)

UNIT II

Physical Layer and Media: Transmission Media: Guided Media – Unguided Media. **Switching:** Circuit Switched Networks – Datagram Networks – Virtual Circuit Networks. **Data Link Layer: Data Link Control**: Framing – Flow and Error Control. **Multiple Access**: Random Access.

(15 Hours)

UNIT III

Network Layer: Logical Addressing: IPV_4 Addresses – IPV_6 Addresses. **Address Mapping, Error Reporting and Multicasting:** Address Mapping – ICMP. **Delivery, Forwarding and Routing:** Delivery - Forwarding – Unicast Routing Protocols.

(15 Hours)

UNIT IV

Transport Layer: Process – to – Process Delivery: Process to process delivery – User Datagram Protocol (UDP) – TCP. **Congestion Control and Quality:** Data Traffic – Congestion – Congestion Control – Quality of Service – Techniques to improve Quality of Service.

(15 Hours)

UNIT V

Application Layer: Domain Name System : Name space – Domain Name Space – Distribution of Name Spaces – DNS in the Internet – Resolution – DNS Messages – Types of records – Registrars – Dynamic Domain Name System (DDNS) – Encapsulation. **Remote Logging, Electronic Mail and File Transfer:** Electronic Mail – File Transfer.

(15 Hours)

TEXT BOOK

Behrouz A. Forouzan. (2016), *Data Communications and Networking*, 4th edition, McGraw Hill Higher Education Private Limited.

REFERENCE BOOKS

1. I.A. Dhotre, V.S. Bagad. (2011), *Data Communication*, Technical Publications.
2. Wayne Tomasi. (2015), *Introduction to Data Communication and Networks,* Pearson Limited.
3. AndrewSTanenbaum. (2015), *Data Communication Networking***,** Pearson Limited.
4. William Stallings. (2019), *Data and Computer Communications*, Pearson Limited.

5. https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

6. https://theswissbay.ch/pdf/Gentoomen%20Library/Networking/Prentice%20Hall%20-%20Computer%20Networks%20Tanenbaum%204ed.pdf

7. https://nptel.ac.in/courses/106/105/106105183/

8. https://nptel.ac.in/courses/106/101/106101209/

9. https://nptel.ac.in/courses/117/105/117105148/

10. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf

Course Code **22PCAE11**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	H	-	L	-	-	-	-
CO2	H	M	M	H	M	L	-	M	-	-
CO3	M	H	-	H	H	L	-	M	-	L
CO4	M	H	M	M	H	M	M	M	-	-
CO5	M	-	H	H	H	H	-	H	-	-

N. Santhi   B. Subashini

Head of the Department   Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester I		Hours/Week: 5	
DSEC-1		Credits: 5	
Course Code	**COMPUTER SECURITY**	Internal	External
22PCAE12		40	60

COURSE OUTCOMES

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

CO1 : explain about network and security requirements, general purpose and trusted OS, unintentional oversights, summarize security features of OS, network attacks, firewall and IDS. [K2]

CO2 : illustrate the topologies, protected objects, points of attack, network technology, articulate about threats, apply the use of cryptography in program security. [K3]

CO3 : Make use of security features in programming, Firewalls and IDS. [K3]

CO4 : categorize the network devices, controls, differentiate malicious and non-malicious codes, examine the security of operating systems & network and analyze types of IDS. [K4]

CO5 : Criticize various routing protocols, security tools, kinds of malicious codes, firewalls and IDS, requirements and methods of protecting network communication, programming and operating system. [K5]

UNIT I

Network definition – Need for computer networks - Components - Types of Networks – Network Topologies - Transmission Modes – Transmission Media – Network Devices - collision and broadcast domains - OSI Layer model - Functions of each Layer – Datalink Layer: framing, error control, flow control – MAC Layer: CSMA protocols – Network Layer: Routing – congestion control – IPV4 – Transport Layer: Connection establishment & release – error and flow control – congestion control – TCP – UDP – Application Layer: DNS

(15 Hours)

UNIT II

Computer security Overview: Computer security concepts – Threats, attacks and assets – **Cryptographic Tools:** Confidentiality with symmetric encryption – Message Authentication and Hash functions – Public key encryption – Digital signature & Key management – **User Authentication:** Electronic user authentication principles – Password based authentication – Biometric authentication.

(15 Hours)

UNIT III

Access Control: Access control principles – Subject, Object & Access rights – Discretionary Access control – **Malicious Software:** Types of malicious software – Propagation (Infected Content Viruses, Vulnerability exploit-worms, Social engineering-spam, email, Trojans) – Payload attack agent (Zombie, Bots) – Pay Load Information Theft (Key loggers, Phishing, spyware) – Payload stealthing (Backdoors, rootkits) - **Denial of Service Attacks:** Denial Of Service Attacks – Flooding Attacks – Distributed Denial of Service Attacks – Defense against DOS Attacks.

(15 Hours)

UNIT IV

Intrusion Detection: Intruders – Intrusion Detection – Analysis Approaches – Host based Intrusion Detection System – Network based Intrusion Detection System – Honeypots – **Firewalls & Intrusion Prevention Systems:** - Need for firewall – Firewall characteristics & access policy – Types of Firewalls – Firewall basing – Firewall location & configuration – Intrusion prevention system.

(15 Hours)

UNIT V

Symmetric encryption & Message confidentiality: Symmetric encryption principles – Data Encryption Standard (DES) – Advanced Encryption Standard (AES) – Stream cipher & RC4 – Cipher block modes of operation – Key distribution – Public Key cryptography & Message Authentication: Secure HASH Functions – HMAC – RSA Algorithm – Diffie Hellman and other asymmetric algorithms.

(15 Hours)

TEXT BOOK (eBook)

William Stallings, Lawrie Brown. (Reprint 2015), *Computer Security Principles and Practice*, 3rd edition, Pearson Education Inc.

REFERENCE BOOKS

1. Behrouz A. Forouzan. (2008), *Cryptography and Network Security*, The McGraw Hill.

2. William Stallings. (2008), *Cryptography and Network Security*, PHI.

3. Cram101 Textbook reviews, *Security in Computing*, 4th Edition.

4. https://nptel.ac.in/courses/106/105/106105031/

Course Code **22PCAE12**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	-	-	L	-	-	-	-
CO2	H	M	H	M	M	L	-	-	-	L
CO3	M	M	-	M	H	L	-	M	-	-
CO4	-	M	H	M	H	H	M	M	-	-
CO5	M	H	H	M	H	M	-	H	-	-

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester I			Hours/Week: 5	
DSEC-1			Credits: 5	
Course Code	**BUSINESS INTELLIGENCE**		Internal	External
22PCAE13			40	60

COURSE OUTCOMES

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

CO1 : understand the fundamentals of business intelligence, user types, CCR Model and its business intelligence Applications. [K2]

CO2 : relate data mining with Knowledge delivery, efficiency and business intelligence. [K3]

CO3 : apply various modeling techniques and method to various situations Ad Hoc Querying, role of mathematical models, Logistic and Production models, Emerging Technologies. [K3]

CO4 : compare data analysis and knowledge delivery stages, Logistic and Production Models, cycle of a business intelligence analysis and Marking model Future Beyond Technology and Emerging Technologies. [K4]

CO5 : choose appropriate technique, Parameterized Reports and Self-Service Reporting, virtual inputs and outputs, BI Search & Text Analytics, Machine Learning, Predicting the Future, business intelligence system. [K5]

UNIT I

Business intelligence: - Effective and timely decisions – Data, information and knowledge – Role of mathematical models. **Business intelligence architectures:** – Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

(15 Hours)

UNIT II

Knowledge Delivery:- The business intelligence user types, standard reports, Interactive analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications. **Visualization:** Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

(15 Hours)

UNIT III

Efficiency: Efficiency measures – The CCR model: Definition of target objectives – Peer groups – identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – other models, Pattern matching – cluster analysis, outlier analysis.

(15 Hours)

UNIT IV

Business Intelligence Applications: Marking models – Logistic and Production models – Case studies.

(15 Hours)

UNIT V

Future of Business Intelligence: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

(15 Hours)

TEXT BOOK:

Efrain Turban, Ramesh Sharda, DursunDelen. (2013), *Decision Support and Business Intelligence Systems*, 9th Edition, Pearson.

REFERENCE BOOK:

1. Larissa T.Moss, S.Atre. (2003), *Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making,* Addison Wesley.

2. David Loshin Morgan, Kaufman. (2012), *Business Intelligence: The Savvy Manager's Guide*, 2nd edition. Addison Wesley.

3. http://seu1.org/files/level8/IT445/IT445%20BOOK%20EDIT.pdf

4. https://www.semanticscholar.org/paper/Business-Intelligence-Roadmap%3A-The-Complete-Project-Moss-Atre/4e9078005edbb68b0a89d0b2c0c493e09c7f2b87

5. https://www.pdfdrive.com/business-intelligence-books.html

Course Code **22PCAE13**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	M	M	H	-	L	-	-	-	-
CO2	M	M	H	M	M	L	-	-	-	L
CO3	M	H	H	-	M	L	-	M	-	-
CO4	-	H	-	M	M	M	M	M	L	-
CO5	-	H	-	M	H	M	M	M	-	-

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M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
Core Course-4	**BIG DATA ANALYTICS**	Credits: 5	
Course Code		Internal	External
22PCAC21		40	60

COURSE OUTCOMES

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

CO1 : understand the concepts of R, Big Data, Hadoop Ecosystem, Data analytics and its role in social media and mobile applications. [K2]

CO2 : illustrate an application using Map Reduce and HBase, and attain the results of applications using Big Data Analytics. [K3]

CO3 : Apply Hadoop Ecosystem elements to provide Big Data solutions in Text Mining, Sentiment Analysis, Opinion Mining and Mobile Analytics. Make use of Data manipulations functions available in R. . [K3]

CO4 : examine the importance of Hadoop framework elements, Social Media Analytics and Mobile Analytical tools and compare Analysis and Reporting of Big Data. [K4]

CO5 : assess the various Hadoop Ecosystem components, types of Analytics and Reporting, Social Media and Mobile Analytics tools, Data visualization using R. [K5]

UNIT I

Getting an Overview of Big Data: What is Big Data? – History of Data Management – Evolution of Big Data – Structuring Big Data – Elements of Big Data – Big Data Analytics – Careers in Big Data – Future of Big Data. **Understanding Hadoop Ecosystem:** Hadoop Ecosystem – Hadoop Distributed File System – MapReduce – Hadoop YARN – Introducing HBase – Hive – Pig and Pig Latin – Sqoop – ZooKeeper – Flume – Oozie.

(15 Hours)

UNIT II

Understanding MapReduce Fundamentals and HBase: The MapReduce Frame work – Techniques to optimize MapReduce Jobs – Uses of MapReduce – Role of HBase in Big Data Processing. **Processing Your Data with MapReduce:** Recollecting the Concept of MapReduce Framework – Developing Simple MapReduce Application – Points to Consider while Designing MapReduce.

(15 Hours)

UNIT III

Understanding Analytics and Big Data: Comparing Reporting and Analysis – Types of Analytics – Points to Consider during Analysis – Developing an Analytic Team – Understanding Text Analytics.

Social Media Analytics and Text Mining: Introducing Social Media – Introducing Key Elements of Social Media – Introducing Text Mining – Understanding Text Mining Process – Sentiment Analysis – Performing Social Media Analytics and Opinion Mining on Tweets.

(15 Hours)

UNIT IV

Mobile Analytics: Introducing Mobile Analytics – Introducing Mobile Analytics Tools – Performing Mobile Analytics – Challenges of Mobile Analytics.

Exploring R: Basic features of R - Handling basic expressions in R - Variables in R - Working with Vectors - Storing and calculating values in R - Creating and using Objects - Interacting with Users - Handling data in R Workspace - Executing scripts.

(15 Hours)

UNIT V

Reading datasets and exporting data from R: using the c() command - Using the scan() command - Reading multiple data values from large files - exporting data from R. **Manipulating and Processing data in R:** Creating data subsets - merging datasets in R - sorting data - putting your data into shape - managing data in R using matrices and data frames. **Perform graphical analysis in R:** Using Plots - saving graphs to external files.

(15 Hours)

TEXT BOOK

DT Editorial Services. (2016), *Big Data, Black Book*, Dream Tech Press, New Delhi.

REFERENCE BOOKS

1. Radha Shankarmani, M. Vijayalakshmi. (2016), *Big Data Analytics*, 2nd edition, Wiley.

2. ParagKulkarni, Sarang Joshi, Meta S. Brown, *Big Data Analytics*, Prentice Hall of India Pvt. Ltd.

3. Douglas Eadline. (2016), *Hadoop 2, Quick-Start Guide*, Pearson Education India.

4. https://nptel.ac.in/courses/106/104/106104189/

5. https://nptel.ac.in/courses/106/107/106107220

6. https://intellipaat.com/blog/big-data-tutorial-for-beginners/

7. https://www.tutorialspoint.com/big_data_tutorials.html.

Course Code **22PCAC21**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	-	-	-	H	-	-
CO2	H	M	-	M	-	-	-	-	L	L
CO3	H	M	-	H	H	M	L	M	L	L
CO4	H	-	M	-	M	M	M	L	-	L
CO5	M	-	L	L	H	H	M	-	-	-

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VIRUDHUNAGAR – 626 001

M.C.A.

(2022-23 onwards)

Semester II		Hours/Week: 5	
Core Course-5	**ADVANCED JAVA PROGRAMMING**	Credits: 5	
Course Code		Internal	External
22PCAC22		40	60

COURSE OUTCOMES

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

CO1 : paraphrase the database concepts using JDBC, web programming concepts including Servlets, JSP, JSTL, AJAX and Struts. [K2]

CO2 : interpret the concepts of JSTL, web application development models, components and Model-View-Controller architecture of struts. [K3]

CO3 : employ basic web programming, JDBC, Servlets, JSP and AJAX in constructing dynamic web applications. [K3]

CO4 : explore the evolution of web application through JDBC, Servlets, JSP, JSTL, AJAX and Struts. [K4]

CO5 : conclude the database connectivity, basics of web programming, JSP, JSTL, AJAX and Struts. [K5]

UNIT I

Database Access with JDBC: Overview of JDBC – JDBC Drivers – Connecting to a Database with Driver Manager – Connecting to a Database using a JNDI Data Source – The Statement Interfaces – Result Sets – Using Metadata.

(15 Hours)

UNIT II

Introduction to Servlets: Servlet life cycle – Example: Kilometers per Liter to Miles per gallon Servlet – Servlet classes – Threading Models – HTTP Sessions. **JSP Syntax and Semantics:** The JSP Development model – Components of a JSP Page – A complete example.

(15 Hours)

UNIT III

Expressions, Scriptlets and Declarations: Expressions – Scriptlets – Declarations. **Request Dispatching:** Anatomy of Request Processing – Including other Resources – The include Directive – The <jsp:include> Action – Which method to Use – Forwarding Requests – The RequestDispatcher Object – Model 1 vs. Model 2.**The JSP Standard Tag Library:** Getting started with JSTL – Core Tags – XML Tags – SQL Tags – Formatting Tags.

(15 Hours)

UNIT IV

Creating AJAX Applications: Writing Ajax – Interacting with Server-Side Code – Passing Data to Server-Side Scripts – Using Ajax with XML.**Serious Ajax Programming:** Working with Multiple Concurrent XML Http Request Requests – Handling JavaScript sent from the Server – A Login Example – Working with Ajax and Head Requests.

(15 Hours)

UNIT V

An Introduction to Struts: A Brief History of Web Application Development – Two Development Models – A Closer Look at the Model-View-Controller Architecture – Enter Struts – Basic Components of Struts – Acquiring Struts – Getting started with Struts. **Building a Simple Struts Application:** Application Overview – Compiling, Packaging and Running the Application – Understanding the Flow of Execution.

(15 Hours)

TEXT BOOKS

1. Phil Hanna. (2003), *The Complete Reference: JSP 2.0*, Tata McGraw Hill Edition.
2. Steven Holzner. (Reprint 2010), *Ajax Bible*, Wiley India Edition.
3. James Holmes, (2007), *The Complete Reference Struts*, 2nd edition, Tata McGraw Hill Publication.
4. https://ezhilnnovativeblog.files.wordpress.com/2012/04/struts-the-complete-reference.pdf

REFERENCE BOOKS

1. Thomas A.Powell. (2008), *The Complete Reference Ajax*, Tata McGraw Hill Edition.
2. Mahesh P.Matha. (2013), *JSP and Servlets, A Comprehensive Study*, PHI Learning Private Limited.
3. Vivek Chopra, Jon Eaves, Rupert Jones, Sing Li, John T.Bell. (2008), *Beginning Java Server Pages*, Wiley Dreamtech.

4. Bryan Basham, Kathy Sierra and Bert Bates. (2008), *Head First Servlets & JSP*, O'Reilly Media, Inc.

5. http://www.nitjsr.ac.in/course_assignment/CA5072CA34115(Internet%20and%20Web%20Technology)=JSP%20Reference%20Book.pdf

6. https://inspirit.net.in/books/html,%20css%20and%20javascript/AJAX%20-%20The%20Complete%20Reference.pdf

7. https://nptel.ac.in/courses/106/105/106105191/

8. https://www.javatpoint.com/jsp-tutorial

9. https://beginnersbook.com/2013/05/servlet-tutorial/

10. https://www.java4s.com/ajax/

Course Code **22PCAC22**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	-	M	-	L	L	-	-	-
CO2	H	H	M	-	H	L	L	M	M	-
CO3	M	M	H	M	H	L	L	H	-	-
CO4	M	-	M	-	M	M	M	M	-	-
CO5	H	-	H	H	M	H	M	M	-	L

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
Core Course-6	**INTERNET OF THINGS**	Credits: 5	
Course Code		Internal	External
22PCAC23		40	60

COURSE OUTCOMES

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

CO1 : discuss the concepts of IoT, Framework of IoT, Machine-to-Machine connectivity, Design principles of Internet Connectivity. [K2]

CO2 : Illustrate the applications of IoT, acquire the knowledge of Internet based communication protocols. [K3]

CO3 : Manipulate data acquiring, organizing and processing the data. Apply sensor data communication protocols,, examine the case studies of IoT . [K3]

CO4 : analyze radio frequency identification technologies and Web Connectivity for Connected Devices Network using Gateway . [K4]

CO5 : Compare Senor technologies, Evaluate Design Complexity using Cloud PaaS. Summarize Web Connectivity for Connected Devices Network using Gateway, SOAP, REST, HTTP Restful and Web sockets.. [K5]

UNIT I

Internet of Things An Overview : Internet of Things – IoT Conceptual Framework –IoT Architectural View – Technology behind IoT – Sources of IoT – M2M Communication – Examples of IoT. **Design Principles for Connected Devices :** Introduction – IoT/M2M System Layers and Design Standardizations – Communication Technologies – Data Enrichment, Data Consolidation and Device Management at Gateway – Ease of Designing and affordability.

(15 Hours)

UNIT II

Design Principles for Web Connectivity: Introduction – Web Communication Protocols for Connected Devices – Message Communication protocols for Connected Devices – Web Connectivity for Connected Devices Network using Gateway, SOAP, REST, HTTP RESTful and Web sockets. **Internet Connectivity Principles:** Introduction – Internet Connectivity – Internet Based Communication – IP addressing in the IoT – **Application** LayerProtocols: HTTP, HTTPS, FTP, TELNET and others.

(15 Hours)

UNIT III

Data Acquiring, Organizing, Processing and Analytics: Introduction – Data Acquiring and Storage – Organizing the data – Transactions, Business Process , Integration and Enterprise Systems –Analytics– Knowledge Acquiring,. Managing and Storing Process. **Data Collection, Storage and Computing Using a Cloud Platform :** Introduction – Cloud Computing Paradigm for Data Collection, Storage and Computing– Everything as a Service and Cloud Service Models – Cloud Computing Paradigm for Data Collection, Storage and Other Models

(15 Hours)

UNIT IV

Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Introduction – Sensor Technology – Participatory Sensing, Industrial IoT and Automotive IoT – Actuator – Sensor Data Communication Protocols – Radio Frequency Identification Technology – Wireless Sensor Network Technology.

(15 Hours)

UNIT V

IoT Privacy, Security and Vulnerabilities Solutions: Introduction – Vulnerabilities, System Requirements and Threat Analysis – Use Cases and Misuse Cases – IoT Security Tomography and Layered Attacker Model – Identity Management and Establishment, Access Control and Secure Message Communication – Security Models, Profiles and Protocols Management. **IoT Case Studies** : Introduction – Design Layers, Design Complexity and Designing using Cloud PaaS –Connected Car and its Applications and Services

(15 Hours)

TEXT BOOK

1. Raj Kamal. (2017), *Internet of Things Architecture and Design Principles*, McGraw Hill Education Private Limited.

2. https://dokumen.pub/internet-of-things-9352605225-9789352605224.html

REFERENCE BOOKS

1. Qusay F. Hassan, AttaurRehman Khan, Sajjad A. Madani. (2018), *Internet of Things: Challenges, Advances and Applications,* CRC Press.

2. Nasreddine Bouhai & ImadSaleh. (2017), *Internet of Things: Evolutions and Innoations*, John Wiley & Sons Publications.

3. Rajkumar Buyya, Amir Vahid Dastjerdi. (2016), *Internet of Things: Principles and Paradigms*, Elsevier.

4. https://www.routledge.com/Internet-of-Things-Challenges-Advances-and-Applications/Hassan-Khan-Madani/p/book/9780367572365

5. https://onlinecourses.nptel.ac.in/noc22_cs53/

6. https://nptel.ac.in/courses/108/108/108108179/

7. https://nptel.ac.in/courses/106/105/106105166/

Course Code 22PCAC23	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	-	-	-	-	-	-	-
CO2	H	-	H	M	-	-	-	M	-	-
CO3	H	H	-	L	M	-	L	-	-	L
CO4	H	-	M	-	M	H	-	H	M	-
CO5	H	M	M	H	-	L	-	M	-	-

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
Core Practical-3	**DATA ANALYTICS USING R LAB**	Credits: 3	
Course Code		Internal	External
22PCAC21P		40	60

COURSE OUTCOMES

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

CO1 : make use of data manipulations functions, data frame, import/export data from/to various sources like excel, CSV, text, SQL and data visualizations. [K3]

CO2 : write programs using R built-in functions, data frame, importing/exporting data from/to various sources like excel, CSV, text, SQL, data visualizations with plots. [K3]

CO3 : key in the programs, execute the programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]

CO4 : explain the given program written using python features and answer questions related to that program. [K4]

CO5 : rewrite program to incorporate modification and justify the desired result. [K5]

Write the following programs in R

1. Data Manipulation using functions available in R.

2. Read and retrieve data from dataset into Data Frame based on conditions.

3. Import Data from various external files (Text, Excel, XML and CSV).

4. Import a dataset and print data and Meta data details (Structure of a data, Print first, last n observations, summary data, no. of rows and columns, column names).

5. Import a dataset and subset dataset based on variable filter conditions (AND, OR, Numeric, Character and selected field).

6. Import a dataset and sort the dataset based on single and multiple variables.

7. Import a dataset, identify and remove overall duplicates and create a dataset with unique records.

8. Import two datasets and implement various Join (Inner, Outer, Left Outer and Right Outer).

9. Data Visualization in R using Line, Pie, Dot, and Bar Charts

10. Create a simple Histogram using R.

11. Create Boxplots using R.

12. Create Scatterplot using R

13. Implement Linear regression.

14. Implement Logistic Regression.

15. Implement Bubble Plot

16. Inventory Control using RMySQL.

17. PayRoll preparation using RMySQL.

18. Library Management Using RMySQL.

19. Bank Transaction Using RMySQL.

20. To perform basic data analytics on a public data set.

21. Perform correlation plot and visualize giving an overview of relationships among data on a public data set.

Course Code **22PCAC21P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	M	L	-	H	-	-
CO2	H	M	-	-	M	M	L	M	L	L
CO3	H	M	L	L	H	L	M	M	-	-
CO4	H	M	M	M	-	M	M	-	-	-
CO5	H	M	H	H	-	H	M	L	-	-

    N. Santhi   N.Santhi

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
Core Practical-4		Credits: 3	
Course Code	**ADVANCED JAVA PROGRAMMING LAB**	Internal	External
22PCAC22P		40	60

COURSE OUTCOMES

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

CO1 : identify the necessary packages, classes and methods to make connection with the database in JDBC and pass input parameters to server side in JSP, Servlets, AJAX and struts. [K3]

CO2 : write programs implementing JDBC, JSP, Servlet, AJAX, struts that use input, output and output formatting in appropriate ways. [K3]

CO3 : key-in the programs and test the programs implemented through JDBC, JSP, Servlets, AJAX and struts to get the expected result. [K3]

CO4 : explain the programs implemented through JDBC, JSP, Servlets, AJAX and struts and deduce the answers for any queries raised. [K4]

CO5 : reconstruct the program to adapt the necessary modifications and justify the desired result. [K5]

Write the following :

1. Program to insert and display Library details using JDBC (Oracle).

2. Program to implement Bank Transaction using JDBC (MS - Access).

3. Program to implement Inventory Database using PrepareStatement (MySQL).

4. Program to insert and display employee details using CallableStatement (MySQL).

5. Program to prepare Electricity Bill using Servlet.

6. Program to display image using Servlet.

7. Program to implement Google Signup Form using Servlet.

8. Program to display Train Detail with MySQL database using Servlet.

9.   Program to display current time using JSP Auto Refresh Header.

10.   Program to display page visitor count using JSP Session Variables.

11.   Program to display day of the date using JSP.

12.   Program to validate form fields and display alert messages using JSP.

13.   Program to demonstrate include directive and display results in another page using JSP.

14.   Program to display session information using JSP.

15.   Program to upload a file using JSP.

16.   Program to display alumni Details with MySQL database using JSTL tags.

17.   Program to load the content of a HTML file using AJAX.

18.   Program to retrieve the content of XML file using AJAX.

19.   Program to retrieve content from database using AJAX.

20.   Program to create a Login form using Struts.

Course Code **22PCAC22P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	-	M	-	L	L	-	-	-
CO2	H	H	M	-	H	L	L	M	M	-
CO3	M	M	H	M	H	L	L	M	-	-
CO4	M	-	M	-	M	M	M	M	-	-
CO5	H	-	H	H	M	H	M	M	-	L

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M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
DSEC-2		Credits: 5	
Course Code	**COMPILER DESIGN**	Internal	External
22PCAE21		40	60

COURSE OUTCOMES

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

CO1 : explain the structure of a compiler, context free grammars, role of lexical analyzer and its design, discuss code optimization and its generation. [K2]

CO2 : develop regular expressions and finite automata, construct efficient parsers, identify the contents of the symbol table and its data structures. [K3]

CO3 : construct basic parsing techniques, examine various syntax-directed translation schemes, illustrate how to optimize and effectively generate machine code. [K3]

CO4 : point out the need of translators, compare parse trees and syntax trees, analyse regular expressions with finite automata, analyse the parsers, examine lexical and syntax analysis, classify various types of errors. [K4]

CO5 : assess the steps in finite automata and regular expression, interpret the errors and code generation problems, summarize the DAG representation of basic blocks. [K5]

UNIT I

Introduction to Compilers: Compilers and translators-Why do we need translators? - The structure of a compiler - Lexical analysis - Syntax analysis - Intermediate code generation - Optimization - Code generation - Bookkeeping - Error handling – Compiler writing tools.

(15 Hours)

UNIT II

Finite Automata and Lexical Analysis: The role of the lexical analyzer – A simple approach to the design of lexical analyzers - Regular expressions – Finite automata – From regular expressions to finite automata – Minimizing the number of states of a DFA.

(15 Hours)

UNIT III

The Syntactic Specification of Programming Languages: Context free grammars- Derivations and parse trees- Capabilities of context free grammars. **Basic Parsing Techniques**: Parsers - Shift reduce parsing - Operator precedence parsing - Top down parsing - Predictive parsers. **Automatic Construction of Efficient Parsers:** LR parsers-The canonical collection of LR(0) items-Constructing SLR parsing tables-Constructing canonical LR parsing tables- Constructing LALR parsing tables.

(15 Hours)

UNIT IV

Syntax-Directed Translation: Syntax directed translation schemes - Implementation of syntax directed translators - Intermediate code - Postfix notation – Parse trees and syntax trees - Three address code, quadruples, and triples - Postfix translations. **Symbol tables:** The contents of a symbol table - Data structures for symbol tables-Representing scope information.

(15 Hours)

UNIT V

Error Detection and Recovery: Errors - Lexical phase errors - Syntactic phase errors - Semantic errors. **Introduction to Code Optimization:** The principle sources of optimization - Loop optimization – The DAG representation of basic blocks. **Code Generation:** Object programs - Problems in code generation - A simple code generator - Peephole optimization.

(15 Hours)

TEXT BOOK

Alfred V. Aho, Jeffrey D.Ullman. (25th Reprint 2002), *Principles of Compiler Design*, Narosa Publishing House, New Delhi.

REFERENCE BOOKS

1. Aho,RaviSethi, Ullman. (1990), *Compilers*, Naraso Publishing House.

2. Jean, Paul Tremblay, Sorenson. (1987), *Compiler Writing*, McGraw Hill International Editions.

3. https://www.gatevidyalay.com/compiler-design/

4. http://dragon-book.jcf94.com/book/ch02/2.2/2.2.html

5. https://www.vssut.ac.in/lecture_notes/lecture1422914957.pdf

6. https://sites.google.com/site/hemavathibitcse/my-forms

7. https://nptel.ac.in/courses/106/105/106105190/

8. https://nptel.ac.in/courses/106/108/106108113/

9. https://www.tutorialspoint.com/compiler_design/index.html

Course Code **22PCAE21**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	L	L	-	-	-	-	-	-
CO2	H	M	-	-	M	L	-	H	-	-
CO3	M	M	M	M	M	L	L	M	L	L
CO4	M	M	M	M	H	M	M	M	L	L
CO5	M	H	H	H	H	H	M	H	L	L

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M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
DSEC-2	**CLOUD COMPUTING**	Credits: 5	
Course Code		Internal	External
22PCAE22		40	60

COURSE OUTCOMES

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

CO1 : understand the fundamentals of cloud computing and its architecture, cloud computing models, cloud infrastructure and platforms. [K2]

CO2 : Illustrate applications using cloud computing, acquire knowledge on cloud data center, security issues and platforms. [K3]

CO3 : make use of cloud benefits, cloud computing architecture, models and services. [K3]

CO4 : examine the factors that affect cloud computing, models of cloud computing and its services. [K4]

CO5 : evaluate and assess the various cloud models, cloud services and security in cloud environments and cloud computing platforms. [K5]

UNIT I

Introduction to Cloud Computing: What is cloud? – History of cloud computing – List of computing techniques – Revolution and maturity of cloud computing – Characteristics of a cloud – Need for cloud computing – Cloud Architecture. **Principles and Working of Cloud Computing:** Principles behind cloud computing – Internet and web 2.0 – Virtualization technology – Distributed technology – Thin Client technology – Working and Migration of cloud computing – web technology and cloud technology.

(15 Hours)

UNIT II

Classification of Cloud: Types of cloud – Private cloud – Public Cloud – Hybrid cloud – Community Cloud – Cloud Management. **Services of Cloud:** Service Oriented Architecture – Services of Cloud – Platform as a service – Infrastructure as a service – software as service – cloud cube model. **Cloud in Action:** Migration Towards cloud platform – cloud hosting – virtual data center – Inter cloud – applications of cloud – Application models of cloud – Advantages of cloud computing – Disadvantages of cloud computing.

(15 Hours)

UNIT III

Real Time Cloud and its application: Amazon cloud and its product – Google cloud and its product – Microsoft cloud and its product – Apple cloud – Vmware cloud and its product – Dropbox – Rackspace cloud – Salesforce cloud platform – Cloud operating system.

(15 Hours)

UNIT IV

Linux and Open source cloud: Linux Architecture – Linux and Cloud computing – List of open source cloud – Openstack cloud – C-DAC and its product – BOSS operating system – MEGHDOOT cloud – Hadoop. **Mobile cloud computing:** Overview of mobile cloud computing – Mobile cloud vs Regular cloud – Mobile cloud apps Vs Native Apps – Mobile cloud computing (MCC) Architecture – Advantages of MCC – Applications of MCC – Bring your own device (BYOD) – Issues for mobile cloud adoption.

(15 Hours)

UNIT V

Business Cloud Computing: Enterprise cloud computing – Cloud computing in Business unit – Business processing as a service – Corporate companies cloud and their usage – Future of computing – Projects and Research in cloud computing. **Issues and Risk in Cloud computing:** Issues in cloud computing – Security issues in cloud – Security management in cloud – Security surveys in cloud computing.

(15 Hours)

TEXT BOOK

Dr. S. Anandamurugan, T. Priya, M.C. Arvind Babu. (2017). *Cloud Computing*, University Science Press, An Imprint of Laxmi Publications Pvt. Ltd.

REFERENCE BOOKS

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, *Cloud Computing: Concepts, Technology & Architecture,* 1st edition*, Pearson Publication Ltd.*

2. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde (2014), *Cloud Computing Black Book,* Dreamtech Publication.

3. https://nptel.ac.in/courses/106/105/106105223/

4. https://nptel.ac.in/courses/106/104/106104182/

5. https://nptel.ac.in/courses/106/105/106105167/

Course Code **22PCAE22**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	M	-	L	-	-	-	-
CO2	M	H	M	H	M	L	-	M	-	L
CO3	H	M	M	-	M	L	-	M	L	-
CO4	-	M	-	M	H	H	M	M	-	-
CO5	M	-	M	M	H	M	M	H	-	-

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M.C.A.
(2022-23 onwards)

Semester II		Hours/Week: 5	
DSEC-2		Credits: 5	
Course Code	**EMBEDDED SYSTEMS**	Internal	External
22PCAE23		40	60

COURSE OUTCOMES

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

CO1 : summarize the key concepts of physical and structural components, instructions, real time operating systems, embedded software development and testing. [K2]

CO2 : employ the real time operating system, its architecture and its services in managing the responses of external events of 8051 microcontroller. [K3]

CO3 : adapt 8051 microcontroller architecture, instruction set and hardware feature concept in exploring embedded system software development tools and debugging techniques. [K3]

CO4 : analyze embedded systems based on microcontroller components, instructions, and real time operating systems. [K4]

CO5 : evaluate the target embedded system software with respect to microcontroller and RTOS. [K5]

UNIT I

Microcontrollers: Different types of Microcontrollers – Processors architectures – Microcontroller memory types – Microcontroller features. **8051 Processor Architecture:** The CPU – 8051 addressing modes – External addressing – Interrupts – 8051 Instruction execution.

(15 Hours)

UNIT II

8051 Instruction set: Data movement instructions – Arithmetic instructions – Bit operators – Execution change operators. **8051 Hardware features:** Device packaging-chip technologies-

power considerations-reset-system clock/oscillators-parallel input/output-level conversions-timers-interrupts-serial I/O-RS-232 level conversion-control store-external memory devices-ordering information.

(15 Hours)

UNIT III

Survey of Software Architecture: Round Robin - Round Robin with Interrupts - Function Queue Scheduling Architecture – Real Time Operating system Architecture - Selecting an Architecture. **Introduction to Real Time Operating Systems**: Tasks and Task states – Tasks and Data – Semaphores and shared data.

(15 Hours)

UNIT IV

More Operating system services: Message Queues, Mail boxes and pipes – Timer Functions – Events - Memory Management – Interrupt Routines in an RTOS Environment.

(15 Hours)

UNIT V

Embedded Software development tools: Hosts and target machines – Linker/Locators for Embedded Software – Getting Embedded Software into the target systems. **Debugging Techniques:** Testing on your Host machine-Instruction set Simulators – The Assert Macro – Using Laboratory tools.

(15 Hours)

TEXT BOOKS

1. MykePredko. (19th Reprint 2010), *Programming and Customizing the 8051 Microcontrollers*, Tata McGraw Hill, New Delhi.

2. David E.Simon. (2011), *An Embedded Software Primer*, Pearson Eduction Inc., New Delhi.

3. David E.Simon. (2011), *(e-Book) An Embedded Software Primer*, Pearson Eduction Inc., New Delhi.

REFERENCE BOOKS

1. Stuart Bennett. (1998), *Real Time Computer Control-An Introduction*, Prentice Hall, International Edition.

2. Ajay V Deshmukh. (2006), *Microcontrollers Theory and Applications*, Tata McGraw Hill.

3. Raj kamal. (2005), *Embedded systems: Architecture and Programming*, Tata McGraw Hill.

4. E. A. Lee and S. A. Seshia, (2017), *(e-Book)Introduction to Embedded Systems - A Cyber-Physical Systems Approach*, Second Edition, MIT Press.

5. https://www.udemy.com/course/8051-microcontroller-embedded-c-and-assembly-language/

6. https://www.coursera.org/learn/introduction-embedded-systems

Course Code **22PCAE23**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	M	M	H	-	L	-	-	-	-
CO2	M	M	H	M	M	L	-	-	-	-
CO3	M	H	H	-	M	L	-	M	-	-
CO4	-	H	-	M	M	M	M	M	-	-
CO5	-	H	-	M	H	M	M	M	-	-

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M.C.A.
(2022-23 onwards)

Semester III		Hours/Week: 6	
Core Course-7	**DIGITAL IMAGE PROCESSING**	Credits: 5	
Course Code **22PCAC31**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : explain image fundamentals, image transforms, image operations and image enhancement, restoration, segmentation and compression. [K2]

CO2 : apply various image processing operations and transforms for real time imaging applications. [K3]

CO3 : develop imaging applications using image enhancement, restoration, segmentation and compression techniques. [K3]

CO4 : examine various image processing operations, types of transforms and interpret m of enhancements, segmentation and lossy and lossless compression. [K4]

CO5 : assess various image transforms and enhancement algorithms and estimate the feasible factors of image compression and segmentation algorithms. [K5]

UNIT I

Introduction to Image Processing: Overview of Image Processing – Nature of Image Processing – Image Processing and Related Fields – Digital Image Representation – Types of Images – Digital Image Processing Operations – Fundamental Steps in Image Processing – Image Processing Applications. **Digital Image Systems**: Overview of Digital Imaging Systems – Sampling and Quantization.

(18 Hours)

UNIT II

Digital Image Processing Operations: Basic Relationships and Distance Metrics – Classification of Image Processing Operations: Arithmetic Operations – Logical Operations – Geometrical Operations – Image Interpolation Techniques – Set Operations. **Digital Image Transform:** Need for Image Transforms – Discrete Cosine Transform – Haar Transform.

(18 Hours)

UNIT III

Image Enhancement: Image Quality and Need for Image Enhancement – Image Enhancement Operations – Image Enhancement in Spatial Domain – Histogram-based Techniques – Spatial Filtering Concepts – Image Smoothing Spatial Filters – Image Sharpening Spatial Filters.

(18 Hours)

UNIT IV

Image Restoration: Introduction to Degradation – Types of Image Degradations – Image Degradation Model. N**oise Modelling**: Noise Categories based on Distribution – Gaussian noise – Impluse or Salt-and-Pepper noise – Poison noise – Exponential noise – Gamma noise - Estimation of Degradation Functions – Image Restoration in Presence of Noise Only – Order-Statistic Filters – Periodic Noise and Band-pass and Band-reject Filtering. **Image Compression:** Image Compression Model – Compression Algorithm and its types – Types of Redundancy – **Lossless Compression Algorithms:** Run-Length Coding – Huffman Coding – Arithmetic coding. **Lossy Compression Algorithms:** Block transform Coding.

(18 Hours)

UNIT V

Image Segmentation: Introduction – Classification of Image Segmentation Algorithms – Detection of Discontinuities – **Edge Detection:** Stages in Edge Detection – Types of Edge Detectors – First-order Detection Operators – Second-order Derivatives Filters – Edge Operator Performance. **Principles of Thresholding**: Histogram and Threshold – Global Thresholding Algorithms – Multiple Thresholding – Adaptive Thresholding Algorithms – Principles of Region Growing. **Color Image Processing:** Introduction – Colour Image Storage and Processing – **ColourModels** : RGB Colour Model – HSI Colour Model.

(18 Hours)

TEXT BOOK

S. Sridhar. (2011), *Digital Image Processing*, 2nd edition, OXFORD University Press, New Delhi.

REFERENCE BOOKS

1. Rafael C. Gonzalez, Richard E. Woods. (2016), *Digital Image Processing*, 3rd edition, Pearson India Education Services Ltd.

2. Rafael C. Gonzalez, Richard E. Woods. (2016), *Digital Image Processing Using MATLAB*, 3rd edition, Pearson India Education Services Ltd.

3. Madhuri A. Joshi. (2006), *Digital Image Processing An Algorithmic Approach*, PHI Learning Pvt. Ltd.

4. Rafael C. Gonzalez, Richard E. Woods. (2016), *(e-Book)Digital Image Processing*, 3rd edition, Pearson India Education Services Ltd.

5. https://nptel.ac.in/courses/117/105/117105135/

Course Code **22PCAC31**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	H	H	M	-	L	-	-	-	-
CO2	M	M	H	M	M	L	-	M	-	L
CO3	-	H	M	-	M	L	-	-	M	L
CO4	M	-	-	H	H	H	M	M	M	-
CO5	M	H	H	H	H	H	-	H	M	-

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M.C.A.
(2022-23 onwards)

Semester III	**MACHINE LEARNING**	Hours/Week: 6	
Core Course-8		Credits: 5	
Course Code **22PCAC32**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : predict the well post learning problems, represent the decision tree, summarize the radial basis functions, distinguish inductive and analytical learning problems. [K2]

CO2 : relate specific and generic hypothesis, construct decision tree for any problem and practice least squared error hypothesis and case based reasoning. [K3]

CO3 : calculate inductive bias from decision tree, relate Bayes Theorem with real world applications, demonstrate genetic algorithm and explanation-based learning. [K3]

CO4 : illustrate candidate elimination algorithm, analyze classification problem using Bayes Optimal classifier. [K4]

CO5 : summarize Bayesian belief Networks, evaluate genetic programming, compare reinforcement learning with deductive learning. [K5]

UNIT I

Introduction: Well Posted Learning Problems – Designing a Learning System – Perspectives and Issues in Machine Learning. **Concept Learning and the General-to-Specific Ordering:** Introduction – A Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Ordering of Hypothesis–Version Spaces and the Candidate Elimination Algorithm – Remarks on Version Spaces and Candidate Elimination.

(18 Hours)

UNIT II

Decision Tree Learning: Introduction – Decision Tree Representation – Appropriate Problems for Decision Tree Learning – The Basic Decision Tree Learning Algorithm – Hypothesis Space Search in Decision Tree Learning – Inductive Bias in Decision Tree Learning. **Artificial Neural Networks:** Introduction – Neural Network Representation – Appropriate problems for Neural Network Learning - Perceptron - Multilayer Networks and the Back Propagation Algorithm.

(18 Hours)

UNIT III

Bayesian Learning: Introduction – Bayes Theorem - Bayes Theorem and Concept Learning – Maximum Likelihood and Least-Squared Error Hypothesis – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – An example: Learning to Classify Text – Bayesian Belief Networks – The EM Algorithm.

(18 Hours)

UNIT IV

Instance Based Learning: Introduction – k-Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case Based Reasoning - Remarks on Lazy and Eager Learning. **Genetic Algorithms:** Motivation -Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning – Parallelizing Genetic Algorithms.

(18 Hours)

UNIT V

Analytical Learning: Introduction – Learning with perfect Domain Theories – Explanation based Learning - Explanation based Learning of search Control Knowledge. **Reinforcement Learning:** Introduction – The Learning task –Q Learning.

(18 Hours)

TEXT BOOK

Tom Mitchell. (2012), *Machine Learning*, 1st edition, McGraw Hill Publications.

REFERENCE BOOKS

1. Shai Ben-David M. (2014), *Understanding Machine Learning: From Theory to Algorithms*, 1st edition, Cambridge University Press.

2. Sivanantham. S, Deepa.S.N. *Principles of Soft Computing*, Wiley India Pvt., 2nd edition.

3. Jeff Barnes, Azure. (2015), *Machine Learning*, Pearson Limited.

4. Ethem Alpaydin. (2012), *Introduction to Machine Learning*, 3rd edition, PHI Learning Private Ltd.

5. https://www.cs.huji.ac.il/w~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf

6. https://nptel.ac.in/courses/106/101/110101145/

7. https://nptel.ac.in/courses/106/106/106106202

Course Code **22PCAC32**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	H	M	H	-	-	-	-	-	-
CO2	H	-	M	H	M	-	-	M	-	-
CO3	M	M	M	-	-	-	-	M	-	L
CO4	H	M	H	-	L	H	M	-	L	-
CO5	H	-	M	H	M	L	H	H	M	-

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M.C.A.
(2022-23 onwards)

Semester III		Hours/Week: 6	
Core Practical-5		Credits: 3	
Course Code	**DIGITAL IMAGE PROCESSING LAB**	Internal	External
22PCAC31P		40	60

COURSE OUTCOMES

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

CO1 : make use of various image arithmetic and logical operations in Image processing applications. [K3]

CO2 : write programs using DCT and HAAR transformations to build image processing applications. [K3]

CO3 : key in the programs, test the programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]

CO4 : explain the given program and deduce the results/answers for any queries raised. [K4]

CO5 : rewrite program to incorporate required modification and justify the desired result. [K5]

Write the following programs in MATLAB

1. To understand and implement Image resizing, Image type conversion, Line profile.

2. To perform arithmetic operations on images.

3. To perform logical operations on images.

4. To perform geometric operations on images.

5. To implement DCT and HAAR transforms.

6. To implement Histogram operations.

7. To implement Contrast stretching and Gamma correction on images.

8. To implement and observe various types noise in images.

9.   To implement spatial filtering and spatial convolution.

10. To implement Mean filters.

11. To implement Order-Statistics filters.

12. To implement image compression algorithms.

13. To implement edge detection operators.

14. To implement image segmentation using various Thresholding.

15. To implement image region growing algorithms.

16. To implement RGB and HSI color models.

17. Calculate PSNR for Noisy Image Given Original Image as Reference

18. Calculate PSNR for dlarray Input

19. Calculate PSNR of Images in Image Sequence

20. Generate ECG for the intensities of a line of pixels from an image.

Course Code **22PCAC31P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	H	H	M	-	L	-	-	-	-
CO2	M	M	H	M	M	L	-	M	-	L
CO3	-	H	M	-	M	L	-	-	M	L
CO4	M	-	-	H	H	H	M	M	M	-
CO5	M	H	H	H	H	H	-	H	M	-

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VIRUDHUNAGAR - 626 001

M.C.A.
(2022-23 onwards)

Semester III		Hours/Week: 6	
Core Practical-6	**PYTHON PROGRAMMING LAB**	Credits: 3	
Course Code		Internal	External
22PCAC32P		40	60

COURSE OUTCOMES

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

CO1 : make use of control structures, mutable and immutable objects, string, built-in and user defined functions, import/export data from/to various sources like excel, CSV, text, SQL and data visualizations. [K3]

CO2 : write programs using control structures, mutable and immutable objects, string, importing/exporting data from/to various sources like excel, CSV, text, SQL, data visualizations with plots. [K3]

CO3 : key in the programs, execute the programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]

CO4 : explain the given program written using python features and answer questions related with that program. [K4]

CO5 : rewrite program to incorporate modification and justify the desired result. [K5]

List of Programs

1. Program using control statements.

2. Program using functions and recursive functions.

3. Program using string methods

4. Program using List methods and built-in functions of List.

5. Program implementing manipulation of matrices.

6. Program using set operations and set methods.

7. Program to create, change and delete a tuple, tuple methods and built-in functions of tuple.

8. Program implementing dictionary and dictionary methods.

9. Program for file handling (Open, read, write, append, close).

10. Program for creating and visualizing graphs.

11. Program for import data from various sources (text, CSV, Excel, URL, Delimited file)

12. Program for importing data from database using SQL.

13. Program for data frame manipulation.

14. Program for data preprocessing (Missing values, categorical values, inconsistencies, scaling and normalization).

15. Program for summarizing, aggregating and grouping data.

16. Program for exporting data from Python (text, CSV, Excel, SQL).

17. Program for data visualization (Bar chart, pie chart, scatter plot, stack plots, venn diagram, Histogram, word cloud).

18. Program for applying watermarking in image.

19. Program implementing image Filters.

20. Program implementing image segmentation

21. Program to implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis.

22. Program to implement and demonstrate candidate-Elimination algorithm.

23. Program to implement and demonstrate ID3 algorithm.

Course Code **22PCAC32P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	H	M	-	-	-	H	-	-
CO2	H	M	H	-	-	-	-	-	L	-
CO3	H	M	-	H	H	M	-	M	-	L
CO4	M	-	M	M	M	L	M	L	-	-
CO5	M	-	L	H	H	M	M	-	-	-

N. Santhi   V.Queen Jemila
Head of the Department   Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR – 626 001

(2020 -21 onwards)

Semester III		Hours/Week: 1	
Course Code	**PRACTICE FOR SET/NET – GENERAL PAPER**	Credits: 1	
20PGOL31		Internal 100	External -

COURSE OUTCOMES

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

CO1	:	discuss various concepts related to higher education system, teaching, communication, research, ICT and environmental studies. [K2]
CO2	:	apply the skills of communication, mathematical, internet and research aptitude in competitive examinations. [K3]
CO3	:	analyze the circumstances, instances, contents and arrive at / choose the best option. [K4]
CO4	:	interpret the data using ICT tools and logical reasoning. [K5]
CO5	:	build self-learning activities to face challenges in their life. [K6]

UNIT I Teaching & Research Aptitude

Teaching: concept, objectives, levels of teaching, factors affecting teaching, Methods of teaching of Higher learning, Evaluation systems.

Research: Meaning, Types, Methods of Research, Steps of Research, Thesis and Article writing, Application of ICT in research.

UNIT II Communication and Higher Education System

Communication, Meaning, types, characteristics of communication, Verbal and non – verbal, Barriers to communication.

Higher Education System: Professional, Technical, skilled Based education, Value education, Policies, Governance and Administration.

UNIT III Comprehension

A passage of text will be given. Answers should be given according to the questions from the passage.

UNIT IV Mathematical, Logical Reasoning and Data Interpretation

Mathematical Logical Reasoning : Number series, letter series, Analogies, Venn diagram and Mathematical Aptitude.

Data Interpretation : Graphical representation and mapping of Data, Data and Governance.

UNIT V ICT and Environmental Studies

ICT : General abbreviations, Basics of Internet, E – mail, Digital initiatives in higher education.

Environmental Studies: Pollution, Impacts of Pollutants, Natural and energy sources, Natural disasters and environmental protection Act.

BOOKS FOR STUDY:

Madan KVS (2019), NTA – UGC NET/SET/JRF- Teaching and Research Aptitude, Pearson India Education Services Pvt. Ltd., Noida.

REFERENCE BOOKS

1.   Rashmi Singh and Asim Khan (2019), UGC-NET Paper- I, Disha Publication, New Delhi.

2.   Dr.Usha Rani Jain (2018), UGC-NET Mital Books India Ltd., New Delhi.

Course code **20PGOL31**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	H	-	-	M	L	-	L
CO2	H	H	L	M	H	M	-	M
CO3	H	M	M	H	H	M	-	M
CO4	H	M	H	H	H	H	-	L
CO5	H	L	M	L	L	H	-	L

                                                          Tmty. K. Anitha

Dr. A. Uma Devi   Tmty.S.Malathi

Head of the Department   Course Designer

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M.C.A.
(2022-23 onwards)

Semester III		Hours/Week: 0	
Extra Credit Course	**E-COMMERCE**	Credits: 2	
Course Code **22PCAO31**		Internal 100	External -

COURSE OUTCOMES

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

CO1 : understand the basis of E-Commerce and M-Commerce, know the legal framework of E-Commerce.

CO2 : apply payment systems in E-Commerce and M-Commerce.

CO3 : Explore the Infrastructure of E-Commerce and M-Commerce.

CO4 : compare the layered architecture of M-Commerce with E-Commerce.

CO5 : summarize the emerging market for multimedia ecommerce.

UNIT I

What is Electronic Commerce?: **-** Introduction – Types of E-Commerce: Business to customer E-Commerce – Customer to Customer E-commerce – Business to Business E-Commerce. Advantages and Disadvantages of E-Commerce – Supply Chain Management in E-Commerce. **Infrastructure for E-Commerce**: Introduction – Local Area Network: Interconnecting LAN Segments. Public Switched Telephone Network: Broadband Connection to Home PC – ISDN Service – Cable Network – Wireless Networks – Microwave and Satellite Network – Private Communication Networks.

UNIT II

Payment Systems in E-Commerce: Introduction – Requirements of e-payment Systems – Credit Card Payment: Credit Card Payment using Secure Socket Layer – Secure Electronic Transaction (SET) Protocol – Dual Signature Scheme. Electronic Funds Transfer: Automated

Cheque Clearance – Electronic Clearing Service. Electronic Cheque Payment: Electronic Clearing of Pay order – E-cheque Format. Electronic Cash: E-Cash Issue and Spending – Anonymous E-Cash – Smart Card-Based Cash Payment. Payment Gateways: Pay Pal. Micro-payments for Information Goods.

UNIT III

M-Commerce: Introduction – Layered Architecture for m-commerce: Mobile Phone–SMS System – Laptops using Wifi LAN Systems – WAP-Enabled Mobile Hand-held Systems – Location Dependent Services. Mobile Communication Infrastructure – Architecture of GSM Cellular Mobile Wireless System – General Packet Radio Service (GPRS) – CDMA 1xEVDO Rev.A – Short Message Service (SMS). Wireless Application Protocol: Mobile Network Operators – Mobile Handset Manufacturers – Service Provider. WAP Gateway: WAP and i-Mode. Wireless Markup Language: XHTML. Secure Wireless Connectivity: Security of Mobile Network-Internet Connection – WAP Gateway Managed by Sensitive Content Providers – WAP Gateway at Server End.

UNIT IV

M-Commerce: Mobile Payment Methods: SIM Card-enabled Payments – Payments based on SMS – Payment using WAP-enabled Mobile Hand-held Device - Mobile Banking. **E-Commerce of Multimedia**: Introduction – E-Publishing of Multimedia – Digitizing and Storing of Books, Audio and Video.

UNIT V

E-Commerce of Multimedia: – Distribution of e-books – Distribution of Audio – Video on Demand - Intellectual Property Issues. **Legal Framework of E-Commerce**: Information Technology Act 2000 – Information Technology (Amendment) Act 2008.

TEXT BOOK

V. Rajaraman. (2011), *Essentials of E-Commerce Technology*, PHI Publications.

REFERENCE BOOKS

1. Bharat Bhaskar, *Electronic Commerce – Frame Work Technologies and Applications*, Tata McGraw Hill.

2. Ravi Kalakota & A.B. Whinston, *Frontiers of Electronic Commerce*, Pearson Education.

3. P. T. Joseph. (2002), *E-Commerce: A Managerial Perspective*, PHI.

4. https://irp-cdn.multiscreensite.com/1c74f035/files/uploaded/introduction-to-e-commerce.pdf

5. https://backup.pondiuni.edu.in/storage/dde/dde_ug_pg_books/E-%20Commerce.pdf

6. https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf

7. https://www.tutorialspoint.com/e_commerce/index.htm

Course Code **22PCAO31**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	M	H	-	L	-	-	-	-
CO2	H	M	H	M	M	M	-	-	-	-
CO3	H	H	H	-	M	L	-	M	L	-
CO4	M	H	-	M	M	M	M	M	-	L
CO5	M	H	-	M	H	M	M	M	-	-

N. Santhi   R. Nagajyothi

Head of the Department   Course Designer

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M.C.A.
(2022-23 onwards)

Semester IV		Hours/Week: 6	
Core Course-9	**C# AND .NET PROGRAMMING**	Credits: 5	
Course Code **22PCAC41**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : understand the basics and Object Oriented aspects of C#, application development on .NET programming. [K2]

CO2 : illustrate applications using object oriented aspects of C#, form controls and event handling. [K3]

CO3 : experiment programs using C# on .NET and develop web based applications on .NET. [K3]

CO4 : examine how C# fits into the .NET platform, compare types of constructors, inheritance and various form controls, analyze data access components. [K4]

CO5 : assess the steps involved in the development of .NET programming, interpret threading and exception handling and summarize various validating controls. [K5]

UNIT I

Introduction to C#: Introducing C# - Understanding .NET – Overview of C# - Class and Objects - Constructors and its types – Inheritance – Indexers – Properties.

(18Hours)

UNIT II

Object Oriented Aspects of C#: Polymorphism - Interface – Operator Overloading - Delegates – Events – Errors – Exception Handling – Threading.

(18 Hours)

UNIT III

Application Development on .NET: Building Windows Application – Adding Controls to Forms – Event handling in Windows Forms – Message Box.

(18 Hours)

UNIT IV

Application Development on .NET: Menu Creation – Inheriting Window Forms – Dialog Box – Accessing Data with ADO .NET – Handling Exceptions – Validating Controls.

(18 Hours)

UNIT V

Web Based Application Development on .NET: Web Forms – Creating the Web Applications Project – Server Controls – Web Services – Session Management Techniques.

(18 Hours)

TEXT BOOK

1. Herbert Schildt. (2012), *The Complete Reference: C# 4.0*, Tata McGraw Hill.
2. R. Manjula Devi, M. Sageetha, C.Sagana. (2015), *C# and .NET Programming*, Charulatha Publications.

REFERENCE BOOKS

1. Christian Nagel et al. (2012), *Professional C# 2012 with .NET 4.5*, Wiley India.
2. Andrew Troelsen. (2010), "*Pro C# 2010 and the .NET 4 Platform*, 5th edition, A Press.
3. Ian Griffiths, Matthew Adams, Jesse Liberty. (2010), *Programming C# 4.0*, 6th edition, O‟Reilly.
4. https://pramoddeokar.files.wordpress.com/2014/07/professional-c-4-0-and-net-4.pdf
5. https://www.udemy.com/course/design-patterns-csharp-dotnet/
6. https://docs.google.com/file/d/0B3OzFFMgEP0tU3RVcmh2Wm5ZUWs/edit?resourcekey=0-wQuLS_uE4BCJL70xs-1JKQ

Course Code 22PCAC41	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	H	M	M	-	-	-	H	-	-
CO2	H	M	H	-	-	-	-	-	L	-
CO3	H	M	-	H	H	M	-	M	-	L
CO4	H	-	M	M	M	M	M	L	-	-
CO5	M	-	L	L	H	H	M	-	-	-

N. Santhi   V. Queen Jemila
Head of the Department   Course Designer

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VIRUDHUNAGAR – 626 001

M.C.A.
(2022-23 onwards)

Semester IV		Hours/Week: 6	
Core Practical-7	**C# AND .NET PROGRAMMING LAB**	Credits: 3	
Course Code **22PCAC41P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : make use of object oriented concepts in C#, design forms with tools in .NET and handling events. [K3]

CO2 : write programs using object oriented aspects of C# and .NET tools. [K3]

CO3 : key in and execute programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]

CO4 : explain the given program and answer questions related with that program. [K4]

CO5 : rewrite program to incorporate modification and justification of the desired result. [K5]

Console Application

1.   Program to perform search operations in a single dimensional array.

2.   Program to multiply two matrices using Rectangular arrays.

3.   Program to implement String manipulation.

4.   Program to demonstrate Boxing and un-Boxing.

5.   Program to implement constructors.

6.   Program to demonstrate virtual and override keywords.

7.   Program to demonstrate abstract class and abstract methods.

8.   Program to implement inheritance concepts.

9.   Program to build a class which implements an interface which already exists.

10.   Program to demonstrate operator overloading.

11. Using Try, Catch and Finally blocks- program to demonstrate error handling.

Window/Web Application

12. To design a simple calculator.

13. To implement constructors.

14. To implement inheritance.

15. To implement an interface.

16. To implement the threading concept.

17. To implement system defined exception handling.

18. To implement user-defined exception handling.

19. To implement modal and modalless dialog box

20. To implement MDI.

21. To implement File & Folder Dialogs controls.

22. To implement Menu creation control.

23. To implement various controls - timer, progress bar, trackbar, panel, link label.

24. To access data using ADO.NET connection.

25. To design web-based applications using validation controls and server controls.

Course Code 22PCAC41P	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	H	M	H	-	L	M	-	M	-	-
CO2	H	M	-	H	L	M	M	M	L	L
CO3	H	M	M	-	L	-	-	-	-	-
CO4	H	M	M	M	-	-	-	-	-	-
CO5	H	M	M	M	M	H	M	M	-	-

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M.C.A.
(2022-23 onwards)

Semester IV		Hours/Week: 6	
Core Practical-8		Credits: 3	
Course Code	**MOBILE APPLICATION DEVELOPMENT LAB**	Internal	External
22PCAC42P		40	60

COURSE OUTCOMES

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

CO1	:	make use of layouts, user interfaces, intents, fragments, multimedia and databases in android applications. [K3]
CO2	:	write programs in Integrated Development Environment using the required tools to develop Android applications. [K3]
CO3	:	key in the programs, test the programs with required input and get expected outputs with neat formatting and prepare the record work. [K3]
CO4	:	explain the given program and deduce the answers for any queries raised. [K4]
CO5	:	rewrite program to incorporate modification and justify the desired result. [K5]

List of Programs

1. Create an App for String Manipulation using Radio Button view.

2. Create an App to list text suggestions using Auto Complete Text View.

3. Create an App to display star rating using Rating Bar.

4. Create an App to sort an array using Spinner View.

5. Create an App for Image Gallery using Button View.

6. Create an App for Image Transition Effect.

7. Create an App for Image effects using GalleryView and ImageSwitcher.

8. Create an App to display a web page using implicit intent.

9. Create an App for Complex number addition and subtraction using explicit intent.

10. Create an App to split an Activity as Fragments.

11.   Create an App to implement different types of image animation using XML.

12.   Create an App for frame by frame animation.

13.   Create an App using Date & Time Picker View.

14.   Create an App using Tabhost.

15.   Create an App for Context, Options & Popup Menu.

16.   Create an App to demonstrate Progress bar.

17.   Create an App to fill Gradient color inside a Shape.

18.   Create an App to display notifications.

19.   Create an App using seek bar, clock and ListViews.

20.   Create an App for Sending SMS.

21.   Create an App to display records from SQLite database table in Grid View.

22.   Create an App to populate a field from SQLite database table into Spinner View.

23.   Create CRUD application using SQLite database.

Course Code **22PCAC42P**	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	H	M	M	-	L	-	-	-	-
CO2	M	H	H	H	M	L	-	M	M	L
CO3	M	M	M	-	H	L	-	M	-	L
CO4	M	-	M	-	H	H	M	M	-	-
CO5	H	M	M	M	H	H	M	H	-	-

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Head of the Department   Course Designer

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M.C.A.
(2022-23 onwards)

Semester IV		Hours/Week: 12
CoreProject-1	**Project - Research Methodology & Ethics -**	Credits: 6
Course Code **22PCAC41PR**		Internal 60 / External 40

COURSE OUTCOMES

On successful completion of the course, the learners should be able to

CO1 : identify the problem in the specified domain using the disciplinary knowledge. [K3]

CO2 : make use of research methodology methods to solve the functions of the problem. [K3]

CO3 : apply the concepts learnt to develop the functionality of the project with ethics. [K3]

CO4 : test the functionality of the project using different types of testing tools. [K4]

CO5 : assess the requirements and evaluate functionality of the project with ethics. [K5]

UNIT I

Research Ethics: Introduction – Types of Research: Theoretical – Experimental – Applied – Qualitative and Quantitative Research – Components of a Research Paper: Title – Abstract – Introduction – Literature Review – Methodology – Results and Discussion – Conclusion – References.

UNIT II

Publication Ethics: Introduction – Style manual in writing: MLA and APA Style – Plagiarism: Introduction – Types of Plagiarism – Avoidance of Plagiarism – Anti Plagiarism – Turnitin and Paper Writer – Journal Indexing – Google Scholar – Scopus – Web of Science – Citation Index – h-index – i-index.

Project Work and Viva-Voce

- Project will be done by the final year students individually in the fourth semester under the guidance of respective guides.

- Course comprises two units Research Methodology theory paper and Project Completion.
- An Internal Assessment for a maximum of 20 marks will be carried out for the theory paper.
- For projects internal marks will be awarded by the respective guide and external marks will be awarded in the external examinations held at the end of the semester.
- The report of the project must be in the prescribed form. It should be typed neatly in MS word (12 pt, Times New Roman, 1.5 spacing)
- The project report should be written in 40 - 50 pages.
- Two copies of the project report with binding should be submitted.

TEXT BOOK

Material prepared by the Faculty Members of Computer Applications, Computer Science and Information Technology Departments.

REFERENCE BOOK

C.R.Kothari (2014). *Research Methodology Methods and Techniques,* 2nd Revision Edition, New Age International Publishers, India.

Course Code 22PCAC41PR	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2.a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	M	-	-	M	-	-	-	L	-	-
CO2	M	H	-	-	M	L	M	M	-	L
CO3	M	M	-	-	M	-	M	-	-	-
CO4	H	M	M	-	M	M	M	M	-	-
CO5	H	M	H	M	H	M	H	-	L	-

Evaluation Pattern (100 marks)					
Internal Assessment (60marks)				External Assessment (40 marks)	
One Periodic Test (20)	Project Report (20)	Pre-Submission Presentation (10)	One Open online Course related to the Project (10)	Project Presentation (30)	Viva Voce (10)

N. Santhi   N. Santhi

Head of the Department   Course Designer