LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2023-24

School: School Of Computer Science & Information Technology									Batch: 2023-25		
Department: Department of Computer Applications									Year: 1st		
Course: Master of Computer Applications (MCA)									Semester: I		

S N	Cate-gory	Course Code	Course Name	Periods			Cre dits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	MCA-109	Programming and Problem-Solving using C	Compulsory Bridge Course									
2	PCC	MCA-119	Advanced Operating System	3	0	0	3	15	25	60	-	-	100
3	PCC	MCA-121	Computer Networks & Security	3	1	0	4	15	25	60	-	-	100
4	PCC	MCA-111	Digital Logic & Computer Architecture	3	1	0	4	15	25	60	-	-	100
5	PCC	MCA-208A	Cyber Security	3	1	0	4	15	25	60	-	-	100
6	PCC	MCA-113	Data Structure and Algorithm	3	0	0	3	15	25	60	-	-	100
7	PCC	MCA-122A	Advanced Database Management Systems	3	0	0	3	15	25	60	-	-	100
8	PCC	MCA-163	Data Structure and Algorithm Lab	0	0	2	1	-	-	-	60	40	100
9	PCC	MCA-169	Advanced Operating System Lab	0	0	2	1	-	-	-	60	40	100
10	PCC	MCA-172	Advanced DBMS Lab	0	0	2	1	-	-	-	60	40	100
11		VAC-101	Value Added - I										
			Total---->	18	3	6	24						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2023-24

School: School of Computer Science & Information Technology											Batch: 2023-25	
Department: Department of Computer Applications											Year: 1st	
Course: Master of Computer Applications (MCA)											Semester: II	

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	MCA-124	Object Oriented Software Engineering	3	1	0	4	15	25	60	-	-	100
2	PCC	MCA-209	Operational Research & Optimization	3	1	0	4	15	25	60	-	-	100
3	PCC	MCA-126	Advanced Java	3	0	0	3	15	25	60	-	-	100
4	PCC	MCA-128	Artificial Intelligence & Robotics	3	0	0	3	15	25	60	-	-	100
5	PCC	MCA-130	Advanced Web Technology	3	1	0	4	15	25	60	-	-	100
6	PEC		Elective-I	3	0	0	3	15	25	60	-	-	100
7	PCC	MCA-176	Advanced Java Lab	0	0	2	1	-	-	-	60	40	100
8	PCC	MCA-178	Artificial Intelligence & Robotics Lab	0	0	2	1				60	40	100
9	PEC		Elective-I Lab	0	0	2	1				60	40	100
10	PCC		Seminar	0	0	2	1					100	100
			Total---->	18	3	8	25						

*EDU SKILL : Student is required to do certification on any EDU Skill Course of his/her choice running during the time period of semester submit the certificate.

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2024-25

School: School Of Computer Science & Information Technology								Batch: 2023-25			
Department: Department of Computer Applications								Year: 2nd			
Course: Master of Computer Applications (MCA)								Semester: III			

S N	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	MCA-120	Statistical and Numerical Computing	3	0	0	3	15	25	60	-	-	100
2	PCC	MCA-219	Machine Learning Using Python	3	0	0	3	15	25	60	-	-	100
3	PCC	MCA-221	Cloud Computing	3	1	0	4	15	25	60	-	-	100
4	PCC	MCA-213	Soft Computing	3	0	0	3	15	25	60	-	-	100
5	PCC	MCA-102A	Research Methodology	3	1	0	4	15	25	60	-	-	100
6	PCC		**Elective-II**	3	0	0	3	15	25	60	-	-	100
7	PCC	MCA-263	Soft Computing Lab	0	0	2	1				60	40	100
8	PCC	MCA-170	Statistical & Numerical Computing Lab	0	0	2	1				60	40	100
9	PCC	MCA-269	Machine Learning Using Python Lab	0	0	2	1				60	40	100
10		RA-101	Reasoning & Aptitude	1	0	0	1					50	50
11	PEC		Value Added - II										
			Total---->	19	2	6	24						

*MOOC/NPTEL: Student is required to do certification on any MOOC Course of his/her choice running during the time period of semester on SWAYAM portal & submit the certificate.

Abbreviations:

PCC: Programme Core Courses
PEC: Programme Elective Courses
AEC: Ability Enhancement Compulsory course
GE: General English

ABQ: Assignment Based Quiz
MSE: Mid Semester Examination
ESE: End Semester Examination
IP: Internal Practical

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2024-25

School: School Of Computer Science & Information Technology												Batch: 2023-25	
Department: Department of Computer Applications												Year: 2nd	
Course: Master of Computer Applications (MCA)												Semester: IV	

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PROJ	MCA-272	Internship/Major Project	0	0	36	18	-	-	-	-	100	100
2	PCC	MCA-280	Seminar	0	0	4	2					100	100
			Total---->	0	0	40	20						

Abbreviations:

PCC: Programme Core Courses

PEC: Programme Elective Courses

AECC: Ability Enhancement Compulsory course

GE: General English

DSE: Discipline Specific Elective Course

L: Lecture

T: Tutorial

P: Practical

ABQ: Assignment Based Quiz

MSE: Mid Semester Examination

ESE: End Semester Examination

IP: Internal Practical

EXP: External Practical

PROJ: Project

ELECTIVE-I	
CODE	**SUBJECT NAME**
MCA-217B	.Net Framework using C#
MCA-132	Android Programming
MCA-134	Computer Graphics and Multimedia

ELECTIVE-I Lab	
CODE	**SUBJECT NAME**
MCA-267	.Net Framework using C# lab
MCA-182	Android Programming lab
MCA-184	Computer Graphics and Multimedia lab

ELECTIVE-II	
CODE	**SUBJECT NAME**
MCA-223	Agile Technology
MCA-225	Internet of Things
MCA-227	E-commerce and Applications
MCA-229	Data Handling and Visualization

Value Added-I		
S.No	**Course Code**	**Course Name**
1	VAC-101	Advance Excel

Value Added-II		
S.No	**Course Code**	**Course Name**
1	VAC-201	Investment Avenue
2	VAC-202	Trading & Investment in Stock Market

SYLLABUS OF MCA 1st SEMESTER

MCA-119	Advanced Operating System	L-T-P 3-0-0

COURSE OBJECTIVE

This course helps the students to understand, how the computer resources like CPU, memory, I/O devices, etc. are managed by the operating system. The learners will also become familiar with the modern concepts of distributed operating system and virtualization

COURSE OUTCOMES (CO)

CO1: Get familiar with the basics of advanced operating systems, concurrency, and various deadlock models

CO2: Comprehend the primitives of distributed operating systems with issues pertaining related to the deadlock detection.

CO3: Aware about security system call and Kerberos.

CO4: Explore the diverse protocols available for the resource management and, fault recovery and tolerance in the distributed system

CO5: Proverbial with the primitives and algorithms available for managing the database operating systems

UNIT I

Introduction: Overview, Functions of an Operating System, Design Approaches, Types of Advanced Operating System - Synchronization Mechanisms, Concept of a Process, Concurrent Processes, The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries, Models of Deadlocks, Resources, System State, Necessary and Sufficient conditions for a Deadlock, Systems with Single-Unit Requests, Consumable Resources, Reusable Resources

UNIT II

Distributed systems: network vs. distributed OS, robustness analysis, design issues; Remote procedure call (RPC), structure, parameter passing, handling partial failures, SunRPC and XDR; Distributed file systems, Servers: stateless and stateful, REST; Distributed shared memory, architecture, design principles, consistency model; Distributed Scheduling, Issues, Components, Algorithms.

UNIT III

Security systems calls, authentication & authorization, reliability, availability & privacy, common attacks, crypto systems, Kerberos, access control lists; OS design: MAC, and iOS; Virtualization: Types, models; Cloud computing, architecture, service and deployment models, cloud challenges

UNIT IV

Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and No blocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols

UNIT V

Multiprocessor and Database Operating Systems: Structures, Design Issues, Threads, Process Synchronization, Processor Scheduling, Memory Management, Reliability / Fault Tolerance; Database Operating Systems, Introduction, Concurrency Control, Distributed Database Systems, Concurrency Control Algorithms

TEXTBOOKS:

a) Silberschatz, A., Galvin, P.B. and Gagne, G., Operating System Concepts (10th ed.), John Wiley, 2018. ISBN 978-1-119-32091-3.

b) Stallings, Willam, Operating Systems Internals and Design Principles (9th ed.), Prentice Hall, 2021. ISBN 978-0134670959.

REFERENCE BOOKS/LEARNING RESOURCES:

a) Andrew S Tanenbaum and Herbert Bos, Modern Operating Systems (1st ed.), Pearson, 2021. ISBN 9789332575776.

b) Mukesh Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems (1st ed.), McGraw- Hill, 2000. ISBN NA.

c) Maurice J. Bach, esign of the Unix Operating Systems (1st ed.), Pearson, 2015. ISBN NA.

MCA-122A	ADVANCE DATABASE MANAGEMENT SYSTEM	L-T-P	Cr
		3-0-0	3

OBJECTIVE

To provide knowledge about various organizations and management information systems, keeping in view the aspects of shareability, availability, evolvability and integrity.

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: Recap to use DBMS features and be familiar with advanced SQL usage

CO2: Understanding of Query Processing and Query Optimization

CO3: Be proficient with Transactions, Concurrency Control and Recovery Systems

CO4: Be exposed to parallel, distributed and deductive databases and object database systems

CO5: To learn about the Database System Architectures.

UNIT I

Coping with System Failures: Introduction to ADBMS, ACID properties, Issues and Models for Resilient Operation, Undo Logging, Redo Logging, Undo/Redo Logging, Logging Rules, Recovery using different Logging methods, Protecting against Media Failures, Non-quiescent Archiving, Recovery using an Archive and Log, Transactions in SQL Serializability, Atomicity, Read-only Transactions, Dirty Reads, other Isolations Levels, Review of PL/SQL

UNIT II

Concurrency Control: Serial and Serializable Schedules, Conflict-Serializability, Precedence Graphs and a Test for Conflict-Serializability, Enforcing Serializability by Locks, The Locking Scheduler, Two-Phase Locking (2PL), Locking Systems with several Lock Modes: shared and Exclusive Locks, The Lock Table, Managing Hierarchies of Database Elements: Locks with Multiple Granularity, The Tree Protocol, Concurrency Control by Timestamps, Concurrency Control by Validation, Constraints and Triggers.

UNIT III

Advanced Transaction Management: Serializability and Recoverability, Recoverable Schedules, ACR, Logical Logging, Recovery from Logical Logs, View Serializability, Polygraphs and the Test for View-Serializability, Resolving Deadlocks, Deadlock Prevention by Ordering Elements and Timestamps, Distributed Databases: Distributed Commit, Two-phase Commit (2PC), Distributed Locking, Long-duration Transactions, Sagas and Compensating Transactions

UNIT IV

The Query Compiler: Parsing, Estimating the cost of operations, Query optimization, Completing the Physical-Query-Plan and Query Execution; Storage management.

UNIT V

Database System Architectures: Object Definition Language (ODL), Object-relational Model, XML and its Data Model, Object-orientation in Query Languages, Logical Query Languages, Centralized and Client-Server Architectures, Parallel Databases, Spatial and Geographic Databases, Multimedia Databases, Mobility and Personal Databases.

TEXT BOOK

1. Silberschatz A., Korth H. F. and Sudarshan S., "Database System Concepts", 3rd edition, McGraw-Hill, International Edition, 1997.

2. S. Chand, Rajiv Chopra, "DBMS(A practical approach)", Revised edition, Pearson.
3. H. Garcia-Molina, J. D. Ullman, and J. Widom: Database Systems: The Complete Book. Pearson

REFERENCE BOOKS
1. R. Ramakrishnan & J. Gehrke, Database Management Systems. Mc Graw Hill
2. Date C. J., "An Introduction to Database Systems", 7th edition, Addison- Wesley, Low Priced Edition, 2000.
3. Desai Bipin, "Introduction to Database Management System", Galgotia Publications, 1991.
4. Elmasri R. and Navathe S. B., "Fundamentals of Database Systems", 3rd edition, Addison-Wesley, Low Priced Edition, 2000.

MCA-121	Computer Networks & Security	L-T-P 3-1-0	Cr. 4

Course Description

Introduction to advanced computer networks concepts, TCP/IP, Local area networks, Reliable data delivery, Routing and forwarding, Network applications and security in computer networks.

COURSE OUTCOMES (CO)

CO1: Examine the functionality of the different layers within the network architecture

CO2: Illustrate TCP/IP model suite protocols

CO3: Design the networks for organization and select the appropriate networking architecture and technologies, subnetting and routing mechanism

CO4: Learn about latest Network technology.

CO5: To get aware about Network security.

Detailed Syllabus

UNIT 1:

Why Computer Networks: Applications of Networks, Connecting Devices, Local Area Networks: LAN topologies: Bus topology, Ring topology, Star topologies, Mesh topology, Hybrid topology, TCP/IP Protocol suite, Physical Layer: Services, Line coding scheme, Modulation, Multiplexing, Switching methods, Ethernet, Bluetooth, Wi-Fi, Wi-Fi Direct, WPA/WPA2/WPA3, Data Link layer: Services, Framing, Switches

UNIT 2:

Reliable Data Delivery: Error detection, Error Correction, Flow control: Stop and wait, Go Back-N, Flow control: S-R Protocol, Error control (Retransmission techniques, timers), Medium Access sub-layer - Channel Allocations, LAN protocols /ALOHA protocols, CSMA, CSMA/CD, Network Layer Protocols: Services (IP, ICMP), IP addressing, subnetting, Super netting (CIDR), IPV4, IPV6.

UNIT 3:

Routing and Forwarding, Static and dynamic routing, Unicast and Multicast Routing, Distance-Vector Routing, Link-State Routing, Shortest path computation- Dijkstra's algorithm, Address mapping-ARP, RARP, BOOTP, DHCP, Transport Layer: Services, UDP and TCP segment formats, connection establishment and termination, Expert Lecture from Industry, Congestion control, Congestion control: Open Loop and closed-loop, Quality of service, Flow characteristics, Techniques to improve QoS.

UNIT 4:

Software-defined networks, network function virtualization, content distribution in peer-to-peer and overlay networks, QoS, Future network architectures. Cloud Systems: Services, Datacenter, 4G and 5G Networks, Body area sensor Networks, Satellite networks, SWARM networks.

UNIT 5:

Introduction to Network Security, Network-based Attacks, Active and Passive Attacks, Phishing and Its Types, Tailgating, Impersonation, Dumpster Diving, Shoulder Surfing, Hoax, Waterhole Attacks, Denial of Service Attacks and its Types, Man in the Middle Attack, Buffer Overflow Attack, Cross-

Site Scripting, SQL Injection Attack, Privilege Escalation, Man in the Browser, Zero-Day Attack, SQL Injection Attack, Privilege Escalation, Man in the Browser.

Proxy Server and its Configurations, IPv6 and IPv6 Security

TEXTBOOKS/LEARNING RESOURCES:

a) B. A. Forouzan, Data communication and Networking (5th ed.), McGraw Hill, 2021. ISBN 10: 1260597822.

b) Andrew S. Tanenbaum and David J. Wetherall, Computer Networks (6th ed.), Pearson, 2021. ISBN 9780137523214.

REFERENCE BOOKS/LEARNING RESOURCES:

a) Trollope, Data Communication & Networking (1st ed.), LAP LAMBERT Academic Publishing, 2020. ISBN 9781485832535.

MCA-208A	CYBER SECURITY	L T P	Cr
		3 1 0	4

OBJECTIVES

To protect information and information infrastructure in cyberspace. To build capabilities to prevent and respond to cyber threats. To reduce vulnerabilities and minimize damage from cyber incidents through a combination of institutional structures, people, processes, technology and cooperation.

COURSE OUTCOMES

The students undergoing this course will be able to:

CO1: Introduce students to the fundamental concepts and principles of cybersecurity.

CO2: Provide students with an understanding of network security principles, protocols, and technologies.

CO3: Introduce students to the principles of cryptography and its application in securing information.

C04: Provide students with an understanding of the most common cybersecurity threats and methods to defend against them.

C05: Provide students with an understanding of cybersecurity governance and management principles and practices.

UNIT-I

INTRODUCTION TO CYBER SECURITY:Introduction to cybersecurity concepts, principles, and practices;Cybersecurity history, evolution, and future trends;Types of cyber threats and attacks;Risk management in cybersecurity;Cybersecurity laws, regulations, and ethics

UNIT II

NETWORK SECURITY:

Network security principles, protocols, and technologies;Wired and wireless network security;Network threats and attacks;Firewalls, intrusion detection and prevention systems;;Virtual Private Networks (VPNs) and secure remote access

UNIT III

CRYPTOGRAPHY:

Cryptography principles and concepts;Types of encryption algorithms;Symmetric and asymmetric key cryptography;Cryptographic protocols and applications;Digital signatures and certificates;

UNIT IV:

WEB AND APPLICATION SECURITY:

Web security principles and technologies;Common web vulnerabilities (e.g., XSS, CSRF, SQL injection);Secure coding practices and techniques;Application security testing and assessment;Secure software development lifecycle (SDLC);

UNIT V

INCIDENT RESPONSE AND MANAGEMENT:
Incident response planning and preparation;Incident detection, analysis, and response;Incident containment, eradication, and recovery;Cybersecurity incident management frameworks (e.g., NIST, ISO);Business continuity and disaster recovery planning;

REFERENCES
1. Cybersecurity: A Practical Guide to the Law of Cyber Risk by Edward R. McNicholas, et al.
2. Cybersecurity for Beginners: What You Must Know About Cybersecurity by Raef Meeuwisse.
3. Network Security Essentials: Applications and Standards by William Stallings.
4. Network Security: Private Communication in a Public World by Charlie Kaufman, et al.
5. Cryptography and Network Security: Principles and Practice by William Stallings.
6. Applied Cryptography: Protocols, Algorithms, and Source Code in C by Bruce Schneier.
7. Cybersecurity: Attack and Defense Strategies by Yuri Diogenes and Erdal Ozkaya.
8. Hacking Exposed 7: Network Security Secrets and Solutions by Stuart McClure, et al.
9. Cybersecurity and Cyberwar: What Everyone Needs to Know by P.W. Singer and Allan Friedman.
10. The Manager's Guide to Cybersecurity Law: Essentials for Today's Business by Tari Schreider.

MCA-113	DATA STRUCTURE AND ALGORITHMS	L T P	Cr
		3-0-0	0

COURSE OBJECTIVE: To relay the theoretical and practical fundamental knowledge of most basic data structure like array linked list, stack, queue, tree & graph To understand the implementation of these data structure ,to be familiar with basic techniques of algorithm analysis and analysis of the algorithms used for implementation of these data structure.

PRE-REQUISITES: Knowledge of basic computer programming.

COURSE OUTCOMES
CO1: Understand the concept of dynamic memory management, data types, algorithm, Big O notation.
CO2: Understand basic data structures such as arrays, linked list, stack and queue.
CO3: Describe the hash function and concepts of collision and its resolution methods.
CO4: Solve problem involving graph, trees and heaps.
CO5: Apply algorithm for solving problems like sorting, searching, insertion and deletion
    of data.

UNIT I: INTRODUCTION TO DATA STRUCTURES AND RUNNING TIME:
Definition of data structures and abstract data types; linear vs. non-linear data structure; primitive vs. non-primitive data structure; static and dynamic implementations; arrays, 1,2-dimensional arrays, insertion & deletion in 1-D array; examples and real life applications. Time complexity; Big Oh notation; running times; best case, worst case, average case; factors depends on running time; introduction to recursion.

UNIT II: STACKS AND QUEUES:
Stacks: definition, array based implementation of stacks, examples: infix, postfix, prefix representation; conversions, applications; definition of queues, circular queue; array based implementation of queues.

UNIT III: LINKED LISTS:
Lists; different type of linked Lists; implementation of singly linked list, linked list implementation of stacks and queues; implementation of circular linked list; implementation of doubly linked list, applications.

UNIT IV: TREES AND GRAPHS:
Definition of trees and binary trees; properties of binary trees and implementation; binary traversal pre-order, post-order, in-order traversal; binary search trees: searching, insertion & deletion. Definition of undirected and directed graphs; array based implementation of graphs; adjacency matrix; path matrix implementation; linked list representation of graphs; graph traversal: breadth first traversal, depth first traversal; implementations and applications.

UNIT V: SORTING AND SEARCHING ALGORITHMS:
 Introduction, selection, insertions, bubble sort, efficiency of above algorithms; merge sort, merging of sorted arrays and algorithms; quick sort algorithm analysis, heap sort, searching algorithms: straight sequential search, binary search (recursive & non–

recursive algorithms).

TEXT BOOK

1. Langsam, Augentem M.J. and Tenenbaum A. M., ―Data Structures using C & C++‖, Prentice Hall of India, 2009.
2. R. S.Salariya, Data Structure and Algorithm, Khanna Publications.

REFERENCE BOOKS

1. Aho A. V., Hopcroft J. E. and Ullman T. D., ―Data Structures and Algorithms‖, Original Edition, Addison-Wesley, Low Priced Edition, 1983.
2. Horowitz Ellis and S ahni S artaj, ―Fundamentals of Data Structures‖, Addison-Wesley Pub, 1984.
3. Horowitz, S ahni and Rajasekaran, ―Fundamentals of Computer Algorithms‖ 2007.
4. Kruse Robert, ―Data Structures and Program Design in C‖, Prentice Hall of India, 1994
5. Lipschetz Jr. Seymour, ―Theory & Problems of Data Structures‖, S chaum 's Outline, Tata McGraw Hill
6. Weiss Mark Allen, ―Data Structures and Algorithms Analysis in C‖, Pearson Education, 2000
7. Corm en T . H . et al., ―Introduction to Algorithms‖, 2nd Edition, Prentice Hall of India, 2001.
8. Dasgupta Sanjay, Christos P. and Vazirani Umesh, ―Algorithms‖, Tata McGraw Hill, 2008
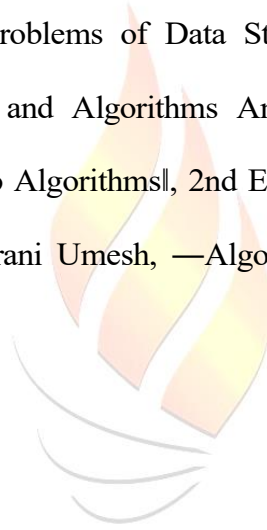
MCA-172	ADVANCE DATABASE MANAGEMENT SYSTEM LAB	L-T-P 0-0-2	Cr 1

OBJECTIVE
To provide knowledge about implementation of practical aspects of database i.e. creation of tables and applying queries using SQL queries

COURSE OUTCOMES
The students undergoing this course will be able:
CO1: To know the basics of structured query language
CO2: To aware about applying different queries on database structured in the form of tables
CO3: To learn about the different SQL queries performed using operators as well as constraints
CO4: To create views from created table to further organize the data
CO5: To learn about the basic operations of relational algebra

LIST OF EXPERIMENTS/EXERCISES
Basic

1. Introduction to SQL.
2. Write a query for:
    I.   Creation of table.
    II. Insertion of data into table.
    III. Displaying the data of table.
    IV. Deletion of data from table.
    V.   Updating the data in a table.
    VI. Modifying the structure of a table.

3. Write a query to implement: Key constraints: primary key constraints, foreign key constraints, not null constraints and unique constraints; use of check constraints.
4. Write a query to implement: Binary operations in Relational Algebra: Union, Intersection, Set Difference, Join, Cartesian product.
5. Write a query to implement: Grouping of data into tables and listing records in ascending order or descending order.
6. Write a query to implement: Creation of sequences and explain use of sequences.
7. Write a query to implement: Access permissions in SQL.

Moderate
1. Finding unique names of all salesmen, deletion of the structure of a table, use of delete command with conditions, updating records of a table with conditions, altering structure of a table and changing size of existing column in the table.
2. Write a query to implement: Arithmetic operators, logical operators and pattern matching operator.
3. Write a query to implement: Aggregate and mathematical functions: count, count(*), Avg, max, min, sum, lower, upper, power , sqrt.
4. Write a query to implement: Creating views from single and multiple tables, drop views and creating index on the table and drop them.
5. Create queries using Triggers and Procedures.

Advance

1. Consider the insurance database given below. The primary keys are made bold and the data types are specified.
   PERSON(driver_id:string , name:string , address:string)
   CAR(regno:string , model:string , year:int)
   ACCIDENT(report_number:int , accd_date:date , location:string)
   OWNS(driver_id:string , regno:string)
   PARTICIPATED(driver_id:string , regno:string , report_number:int , damage_amount:int)
   1)Create the above tables by properly specifying the primary keys and foreign keys.
   2)Enter at least five tuples for each relation.
   3)Demonstrate how you:
   a.Update the damage amount for the car with specific regno in the accident with report number 12 to 25000.
   b.Add a new accident to the database.
   4)Find the total number of people who owned cars that were involved in accidents in the year 2008.
   5)Find the number of accidents in which cars belonging to a specific model were involved.
2. Consider the following relations for a order processing database application in a company.
   CUSTOMER(custno:int , cname:string , city:string)
   ORDER(orderno:int , odate:date , custno:int , ord_amt:int)
   ORDER_ITEM(orderno:int , itemno:int , quantity:int)
   ITEM(itemno:int , unitprice:int)
   SHIPMENT(orderno:int , warehouseno:int , ship_date:date)
   WAREHOUSE(warehouseno:int , city:string)
   1)Create the above tables by properly specifying the primary keys and foreign keys.
   2)Enter at least five tuples for each relation.
   3)Produce a listing: custname , No_of_orders , Avg_order_amount , where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer.
   4)List the orderno for orders that were shipped from all the warehouses that the company has in a specific city.
   5)Demonstrate the deletion of an item from the ITEM table and demonstrate a method of handling the rows in the ORDER_ITEM table that contains this particular item.
3. Consider the following database of student enrollment in courses and books adopted for that course.
   STUDENT(regno:string , name:string , major:string , bdate:date)
   COURSE(courseno:int , cname:string , dept:string)
   ENROLL(regno:string , courseno:int , sem:int , marks:int)
   BOOK_ADOPTION(courseno:int , sem:int , book_isbn:int)
   TEXT(book_isbn:int , book_title:string , publisher:string , author:string)
   1)Create the above tables by properly specifying the primary keys and foreign keys.
   2)Enter atleast five tuples for each relation.
   3)Demonstrate how you add a new text book to the database and make this book to be adopted by some department.
   4)Produce a list of text books (includes courseno , book_isbn , book_title) in the alphabetical order for courses offered by the 'CS' department that use more than two books.
   5)List any department that has all its books published by a specific publisher.

4. The following are maintained by abook dealer.
AUTHOR(author_id:int , name:string , city:string , country:string)
PUBLISHER(publisher_id:int , name:string , city:string , country:string)
CATALOG(book_id:int , title:string , author_id:int , publisher_id:int , category_id:int , year:int , price:int)
CATEGORY(category_id:int , description:string)
ORDER_DETAILS(order_no:int , book_id:int , quantity:int)
1)Create the above tables by properly specifying the primary keys and foreign keys.
2)Enter at least five tuples for each relation.
3)Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
4)Find the author of the book that has maximum sales.
5)Demonstrate how you increase the price of books published by a specific publisher by 10%.

5. Consider the following database for a banking enterprise.
BRANCH(branch_name:string , branch_city:string , assets:real)
ACCOUNT(accno:int , branch_name:string , balance:real)
DEPOSITOR(customer_name:string , accno:int)
CUSTOMER(customer_name:string , customer_street:string , customer_city:string)
LOAN(loan_number:int , branch_name:string , amount:real)
BORROWER(customer_name:string , loan_number:int)
1)Create the above tables by properly specifying the primary keys and foreign keys.
2)Enter at least five tuples for each relation.
3)Find all the customers who have at least two accounts at the main branch.
4)Find all the customers who have an account at all the branches located in a specific city.
5)Demonstrate how you delete all account tuples at every branch located in a specific city.

MCA-111	DIGITAL LOGIC AND COMPUTER ARCHITECTURE	L	T/SDA	P	Credit
		3	1	0	4

OBJECTIVE

The objective of this course is to introduce the organization of a computer and its principal components, digital logic gates, combinational and logical circuits and micro operations

COURSE OUTCOMES

The students undergoing this course will be able to:
CO1: Understanding of Boolean algebra and Simplification of Boolean Functions
CO2: Understanding the digital logic gates
CO3: Understanding the Combinational Logic and Sequential Logic
CO4: Understanding of Microprocessor Architecture and Micro-operations
CO5: Understanding of CPU and Binary Arithmetic

UNIT I

Information Representation: Number Systems - Binary, Octal, Decimal, and Hexa-Decimal; Number Base Conversions; Binary Arithmetic; Complements: (r-1)'s Complement, r's Complement, Subtraction using Complements; Floating Number Fixed-point Representation, Floating-point Representation; Binary Codes for Decimal Digits: BCD Code, Excess-3 Code, 84- 2-1 Code, 2421 Code, Reflected Code; Error Detection Code; Character Representation – ASCII, EBCDIC.

UNIT II

Boolean Algebra, Logic Gates and simplification: Boolean Algebra-Basic Definitions, Postulate, Basic Theorems and Properties of Boolean Algebra; Boolean Functions, Canonical and Standard Forms: Minterms and Maxterms, SOP, POS Conversion Between Canonical Forms, Standard Form of a Boolean Function; Other Logical Operations; Digital Logic Gates, Implementation of Boolean Functions, Simplification using boolean Algebra and Karnaugh Maps (K-Map) Method.

UNIT III

Cobinational and Sequential Logic Circuit: Overview of Combinational Logic; Combinational Logic Design Procedure; Design of Some Standard Combinational Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Code Conversion; Decimal Adder, BCD Adder, Magnitude Comparator, Decoders, Encoder, Multiplexers, De-multiplexer, Flip-Flops: RS Flip Flop, Clocked RS, JK Flip Flop, Master Slave JK Flip Flop, D Type Flip Flop, T Type Flip Flop, State Table, State Diagram, State Equations, Flip Flop Characteristic Tables; Flip Flop Excitation Tables; Design of Sequential Circuits.

UNIT IV

Register Transfer and Micro Operations: Register Transfer Language (RTL); Register Transfer; Bus Transfer; Memory Transfers; Arithmetic Microoperations; Logic Microoperations, List of Logic Microoperations, Addressing Modes, Data Transfer.

UNIT V

Central Processing Unit (CPU): Introduction; General Register Organization; Control Word; Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expression. Instruction

Format – Three Address Instructions, Two Address Instructions, One Address Instructions, Zero Address Instructions. Parallel Processing; Pipelining – Arithmetic Pipeline, Instruction Pipeline

TEXT BOOKS

1. Mansaf Alam & Bashir Alam: Digital Logic Design.
2. PHI M. Morris Mano: Digital Logic and Computer Design.
3. Pearson M. Morris Mano: Computer System Architecture.

REFERENCE BOOKS

1. Pearson William Stalling: Computer Organization and Architecture.
2. Prentice Hall V. Rajaraman & T. Radhakrishnan: Computer Organization and Architecture.
3. PHI Donald D. Givone: Digital Principles and Design. McGraw Hill

MCA-163	DATA STRUCTURES & ALGORITHMS LAB	L T P	Cr
		0 0 2	1

LIST OF EXPERIMENTS

ARRAY OPERATIONS
1. Write a program to insert an element at given position in linear array
2. Write a program to insert an element in sorted array.
3. Write a program to delete an element from given position in linear array
4. Perform following operations on matrices using functions only
   a) Addition b) Subtraction c) Multiplication   d) Transpose

SEARCHING
5. Search an element in a linear array using linear search.
6. Using iteration and recursion concepts write programs for finding the element in the array using Binary Search Method

RECURSION
7. Write a program to compute factorial of given number using recursion
8. Write as program to solve Tower of Hanoi problem using recursion
9. Write a program to find power of given number using recursion

STACK & QUEUE
10. Write a program for static implementation of stack
11. Write a program for dynamic implementation of queue
12. Write a program for static implementation of circular queue
13. Write a program for dynamic implementation of queue
14. Write a program to evaluate a postfix operation

LINKED LIST
15. Create a linear linked list & perform operations such as insert, delete at end , at beg & reverse the link list
16. Create a circular linked list & perform search, insertion & delete operation
17. Create a doubly linked list & perform search, insertion & delete operation

TREE & GRAPH
18. Write program to implement binary search tree. (Insertion and Deletion in Binary Search Tree)
19. Write program to simulates the various tree traversal algorithms
20. Write program to simulate various graph traversing algorithms.

SORTING ALGORITHMS
21. Write program to implement Bubble, Insertion & selection sort.
22. Write program to implement quick sort
23. Write program to implement merge sort
24. Write a program to implement heap sort

TEXT BOOK
1. A.K. Sharma – Data structure Using C, 2nd edition pearson 2013

2. Langsam, Augentem M.J. and Tenenbaum A. M., ―Data Structures using C & C++‖, Prentice Hall of India, 2009.

REFERENCE BOOKS

1. R. S. Salaria -Data Structure Using C
2. Kruse Robert, ―Data Structures and Program Design in C‖, Prentice Hall of India, 1994
3. Lipschitz Jr. Seymour, ―Theory & Problems of Data Structures‖, Schaum's Outline, 2nd Edition, Tata McGraw Hill

SYLLABUS OF MCA 2nd SEMESTER

MCA-126	ADVANCED JAVA	L-T-P	Cr
		3-0-0	3

OBJECTIVE

The objective of learning advanced Java is to gain proficiency in using advanced concepts and frameworks in Java programming to develop enterprise-level applications that are scalable, secure, and maintainable. Advanced Java training equips learners with the skills required to design, develop and deploy applications that are capable of handling complex business processes and challenges. This course is intended to help learners excel in their careers as Java developers and software engineers.

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: Understanding of advanced Java concepts: Students will be able to understand the advanced Java concepts such as multithreading, networking, Java Database Connectivity (JDBC), Java Server Pages (JSP) and Servlets, Enterprise JavaBeans (EJB), Spring Framework, Hibernate Framework, and RESTful web services.

CO2: Ability to develop Java applications: Students will be able to develop Java applications using advanced Java concepts and frameworks.

CO3: Knowledge of Java design patterns: Students will be able to apply Java design patterns to solve complex problems in their applications.

CO4: Proficiency in using development tools: Students will be able to use various development tools, such as Integrated Development Environment (IDE), testing frameworks, and build tools to develop and test their applications.

CO5: Knowledge of emerging trends: Students will be able to stay updated with the emerging trends in advanced Java development and apply them in their applications.

UNIT I

Servlet and JSP: Basics of Servlet - Servlet Request, Servlet Collaboration, Servlet Config Servlet Context, Attribute Session Tracking, Event and Listener, Servlet Input Stream and Servlet Output Stream, Annotation Servlet, Filter, Basics of JSP, Scripting elements, 9 Implicit Objects Directive Elements, Action Elements, Expression Language, MVC in JSP, JSTL, Custom tags

UNIT II

Enterprise JavaBeans (EJB): Overview of EJB and its architecture, Stateless and stateful session beans, Message-driven beans, EJB lifecycle and transactions, Developing EJB applications.

UNIT III

JavaMail API , Design Pattern, JUnit, Maven: Sending Email, Sending email through Gmail server, Receiving Email, Sending HTML content, Singleton, DAO, DTO, MVC, Front Controller, Factory Method, JUnit: What and Why?, Types of Testing, Annotations used in Junit, Assert class, Test Cases, Maven: What and Why?, Ant Vs Maven, How to install Maven?, Maven Repository, Understanding pom.xml, Maven Example, Maven Web App Example, Maven using Eclipse

UNIT IV

Spring and Hibernate Framework: Introduction to Spring Framework, Dependency injection and inversion of control Spring MVC, Spring Data and Spring Security, Spring Boot, Introduction to Hibernate Framework, ORM (Object-Relational Mapping) basics, Hibernate architecture and components, Mapping entities to database tables, Hibernate queries and criteria,

UNIT V

Web Technology: Introduction to HTML, HTML Tags, Creating Forms, Creating tables, Managing home page, Introduction to CSS, Three ways to use CSS, CSS Properties, Designing website, Working with Templates, Introduction to Javascript, Three ways to use Javascript, Working with events, Client-side Validation, Introduction to JQuery, Validation using JQuery, JQuery Forms, JQuery Examples, Introduction to AJAX, Servlet and JSP with AJAX, Interacting with database

TEXT BOOK

1. "Java Concurrency in Practice" by Brian Goetz et al. (2006) Goetz, B., Peierls, T., Bloch, J., Bowbeer, J., Holmes, D., & Lea, D. (2006). Java concurrency in practice. Addison-Wesley.

2. "Effective Java" by Joshua Bloch (2017) Bloch, J. (2017). Effective Java. Addison-Wesley Professional.

3. "Hibernate in Action" by Christian Bauer and Gavin King (2004) Bauer, C., & King, G. (2004). Hibernate in action. Manning Publications Co.

REFERENCE BOOKS

1. "Core Java Volume II--Advanced Features" by Cay S. Horstmann (2016)

   Horstmann, C. S. (2016). Core Java volume II--advanced features. Pearson Education.

2. "Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam" by Bryan Basham, Kathy Sierra, and Bert Bates (2008)

   3. Basham, B., Sierra, K., & Bates, B. (2008). Head first servlets and JSP: Passing the Sun Certified Web Component Developer Exam. O'Reilly Media, Inc.

MCA-209	**Operational Research and Optimization**	**L T P**	**Cr**
		3 1 0	**4**

OBJECTIVE:

Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

PRE-REQUISITE:

Knowledge of Linear Algebra, Applied Probability Statistics and Mathematical Programming

COURSE OUTCOMES

CO1: Understanding the concept of operation Research, its models and Linear Programming Problem
CO2: Understanding of Transportation problem and Various Assignment models
CO3: Understanding of Sequencing Models and Replacement Models
CO4: Formulation of optimization model
CO5: Applying appropriate optimization technique.

UNIT I

INTRODUCTION TO OPERATIONAL RESEARCH : Basic definition, Scope, Objectives, Phases-characteristics and phases and limitations of Operation Reserach-Types of models-Operations Research models- applications.
Allocation: Linear Programming Problem Formulation-Formulation , Graphical solution-Simplex method-Artificial variable techniques: Two-phase method, Big-M method.

UNIT II

Transportation problem – Formulation-Optimal solution, unbalanced transportation problem- Degeneracy.
Assignment Model- Formulation-Optimal solution, – Variants of Assignment problem-Travelling salesman problem.

UNIT III

Sequencing Models- Introduction-Flow-Shop sequencing- n jobs through two machines – n jobs through three machines- Job shop sequencing-two jobs through 'm' machines
Replacement Models: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

UNIT IV

Theory of Games: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle- m x 2 & 2 x n games- Graphical method.
Inventory: Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models _ Demand may be discrete variable or continuous variable- single period model and no setup cost.

UNIT-V

Dynamic Programming: Introduction- Terminology, Bellman's principle of optimality-
Applications of Dynamic programming- shortest path problem- linear programming
problem.

Inventory Models:Inventory cost,models with deterministic demand-model(a) demand rate
uniform and production rate infinite, model (b) demand rate non-uniform and production rate
infinite,model(c)demand rate uniform and production rate finite.

TEXT BOOKS:

1. P. Sankara Iyer , "Operational Research", Tata McGraw-Hill, 2008
2. A.M. Natarajan,P. Balasubramani, A.Tamilarasi, "Operation Research", Pearson
Education,2005.

REFRENCES:

1. J K Sharma., "Operations Research Theory & Applications , 3e", Macmillan India Ltd, 2007.
2. P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.
3. J K Sharma., "Operations Research, Problems and Solutions, 3e", Macmillan India Ltd.
4. N.V.S. Raju, "Operations Research", HI-TECH, 2002.
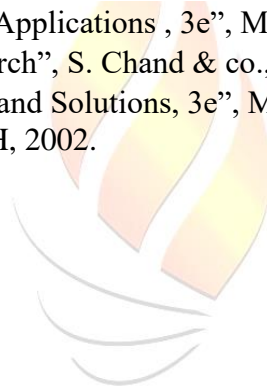
MCA-130	ADVANCED WEB TECHNOLOGY	L-T-P	Cr
		3-1-0	4

OBJECTIVE

It aims to provide the information to students to study the architecture of Dot Net framework. It helps them to understand the basic principles of C# development. Students will learn advanced windows and web development techniques using dotNET.

Pre-Requisites:

Basics of programming, Structure and HTML Tags, Images, List, Tables, Anchors and Form Elements

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: To Study the architecture of Dot Net framework

CO2: To Understand the basic principles of C# development

CO3: To Create UI applications using C#

CO4: To Design and develop secure web applications using asp.net according to industry standards

CO5: To Define and create custom web services

UNIT I

Introduction to ADO.NET: Benefits of ADO.NET, ADD.NET compared to classic ADO, ADO.NET architecture (Connected and Disconnected), Shared and Database-Specific Classes, Using Database connection. Working with DataSets, Managed Providers, Data Binding, Typed DataSets, Working with Data Reader, Transactions

UNIT II

OOP C#: Classes and Objects Instance Variables, Methods, Constructors, Properties, Access Specifiers, Static members and methods Inheritance Levels of Inheritance, Constructor and Inheritance, Polymorphism, Interfaces, Abstract classes, Delegates, Indexers, Sealed Classes, Exception handling Collections and Generics Bounded and Unbounded Collections, Generic Programming Generic classes, Functions, Constraints on Generic Programming 10

UNIT III

DATABASES and C#:

File Handling Text Files, Binary Files, String Processing, Serialization and Deserialization ADO.Net Connected and Disconnected, Architecture of ADO. Net, Commands, Datasets, Data Readers, Data Adapters, Working with Stored Procedures LINQ and the ADO.NET Entity Framework LINQ Introduction, Mapping Your Data Model to an Object Model, Introducing Query Syntax 08

UNIT IV

DATA & STATE MANAGEMENT IN ASP.NET:

ASP.NET Websites with Themes and MasterPages, Data Source Controls, Data Bound Controls, ASP.NET State Management-Client Side and Server Side. ASP.NET and AJAX 10

UNIT V

WEB SERVICES:

XML, Web Services Architecture, UDDI,SOAP and its Format, WSDL, Create and Consuming XML Web Service Simple and Databases, WCF- Architecture, End Points, Types of Contracts, Web Applications and Security 08

Textbook:
Uttam K. Roy, "Web Technology", Oxford Publication

References Books:
1. Musciano Chuck, "HTML & XHTML: The Definitive Guide", Bill Kennedy, 4th Edition, 2000.
2. Holzner Steven, "XHTML Black Book", Paraglyph Press, 2000.
3. Guy W.Lecky-Thompson, "Web Programmin", Cengage Learning, 2008.
4. Kamal Raj, "Internet and Web Technologies", Tata McGraw Hill, 2002

Web References:
1. http://W3schools.com.
2. http://www.uniweb.be/
3. http://www.sagaciousindia.com/
4. MSDN: Learn to Develop with Microsoft Developer Network: https://msdn.microsoft.com/

MCA- 128	ARTIFICIAL INTELLIGENCE & ROBOTICS	L T P	Cr
		3 0 0	3

PREREQUISITES: Data Structure, Electronics and Mechanics Concepts

COURSE OBJECTIVES:
1. To introduce foundational knowledge about robotics and application of robotics
2. To make the students familiar with concepts of Artificial Intelligence and reasoning.
3. To discuss the implementation of robots

COURSE OUTCOMES

Student will be able to
CO1: Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems. Solve basic AI based problems
CO2: Define the concept of Artificial Intelligence and Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3: Understand the basic concepts of working of robot
CO4: Understand the various robot programming languages
CO5: Use and apply techniques for robot programming

UNIT 1: INTRODUCTION TO AI AND SEARCH TECHNIQUES: Foundation and history of AI; data, information and knowledge; AI problems and techniques – AI programming languages, problem space representation with examples; blind search strategies, breadth first search, depth first search, heuristic search techniques: hill climbing: best first search, A * algorithm AO* algorithm, Minimax search procedure for Game Playing.

UNIT 2:
KNOWLEDGE REPRESENTATION ISSUES AND TECHNIQUES: Predicate logic; representing knowledge using rules. Semantic nets, partitioned nets, parallel implementation of semantic nets; frames, forward and backward chaining; frame based systems.
Reasoning under uncertainty, non-monotonic reasoning; Review of probability; Baye's probabilistic interferences and Dumpster Shafer theory; statistical reasoning, fuzzy reasoning.

UNIT 3: ROBOTICS SYSTEM
Introduction to robotics, Classification of Robots, Major components of robots, Robotics Applications, Artificial Intelligence in robotics, Basic components of a robot system, Functions of a robotic system, specification of a robotic system

UNIT 4: MODELING AND END EFFECTORS
Motion Conversion, Modeling of the mechanical System, Kinematics chain, Classification of end effectors-tools as end effectors-drive system for grippers, mechanical adhesive, vacuum magnetic, grippers, hooks and scoops, gripper force analysis, and gripper design, active and passive grippers

UNIT 5: ROBOT PROGRAMMING

Software and hardware considerations, Introduction to robotic programming, Robotic extension of general purpose programming, Robot specific programming languages, VAL – basic commands, command based programming, sample programs.

Text Books

1. Rich Elaine and Knight Kevin, ―Artificial Intelligence 3rd Edition, Tata McGraw Hill, 1991
2. Richared D.Klafter.Thomas Achmielewski and Mickael Negin, Robotic Engineering an Integrated approach prentice hall India- newdelhi-2001
3. John Craig, Introduction to Robotics Mechanics and Control, Pearson, 4th Edition, 2022
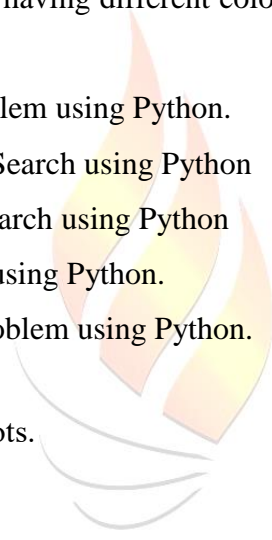
Reference Books

1. Siciliano, Khatib, Springer Handbook on Robotics
2. Saeed B.Nikku, Introduction to Robotics, analysis, control and applications Wiley-India2nd edition-2011
3. Danny Staple, Learn Robotics Programming: Build and control AI-enabled autonomous robots using the Raspberry Pi and Python, 2nd Edition
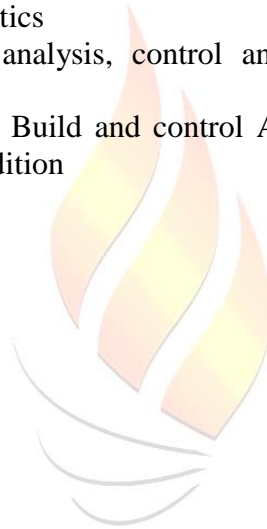
MCA- 178	**ARTIFICIAL INTELLIGENCE & ROBOTICS LAB**	**L T P**	**Cr**
		0 0 2	**1**

LIST OF EXPERIMENTS

1. Study of Python programming language.

2. Write a program to find out route distance between two cities using Python.

3. Write a program to implement Tower of Hanoi using Python.

4. Write a program to calculate factorial of a number using Python.

5. Write a program to print the list of customer having different colored cars with price and model available using Python.

6. Write a program to implement water jug problem using Python.

7. Write a program to implement Breadth First Search using Python

8. Write a program to implement Depth First Search using Python

9. Write a program to solve 8-Queens problem using Python.

10. Write a program to solve Monkey Banana problem using Python.

11. Study of robotic programming.

12. Identify equipment's and sensors used in robots.

MCA-176	ADVANCED JAVA LAB	L-T-P	Cr
		0-0-2	1

OBJECTIVE

The objective of an Advanced Java Lab is to provide students with hands-on experience in developing complex and scalable applications using advanced Java technologies and frameworks. The lab is designed to supplement theoretical concepts covered in lectures and to help students understand how to apply these concepts in practice.

The specific objectives of an Advanced Java Lab may include:

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: Ability to develop scalable and maintainable enterprise-level applications using advanced Java technologies and frameworks.

CO2: Proficiency in designing and implementing web-based applications using Servlets, Java Server Pages (JSP), Enterprise JavaBeans (EJB), Spring Framework, and Hibernate Framework.

CO3: Knowledge of web service development using Java and ability to create RESTful web services.

CO4: Familiarity with software testing methodologies and ability to test and debug Java applications using testing frameworks such as JUnit.

CO5: Capability to integrate different Java technologies and frameworks to develop comprehensive and robust applications.

LIST OF TOPICS

Session 1: Introduction to Advanced Java

Installation of Java EE tools
Overview of Java Database Connectivity (JDBC)
Introduction to Servlets and Java Server Pages (JSP)

Session 2: Servlets

Creating a servlet
Handling HTTP requests and responses
Servlet lifecycle and filters

Session 3: Java Server Pages (JSP)

JSP architecture and lifecycle
Basic JSP syntax and directives
Using JSP tags and expressions

Session 4: JavaBeans

Introduction to JavaBeans
Creating and using JavaBeans in JSPs
JSTL and EL expressions

Session 5: Enterprise JavaBeans (EJB)

Introduction to EJBs
Session and message driven EJBs
EJB lifecycle and deployment

Session 6: Spring Framework

Introduction to Spring Framework
Spring configuration and dependency injection
Spring MVC architecture and controllers

Session 7: Hibernate Framework

Introduction to Hibernate Framework
Hibernate configuration and mapping.
CRUD operations using Hibernate.

Session 8: Web Services

Introduction to web services
SOAP and RESTful web services
Developing web services using Java

Session 9: Project Work

Implementation of a web application using advanced Java concepts and frameworks, Integration of different advanced Java technologies in the project Testing and deployment of the project

Textbooks:

Title: "Advanced Java Programming: A Practical Guide to Developing Applications"
Author: B. N. Suresh
Publication Date: 2018
Publisher: Wiley India Pvt Ltd
ISBN-10: 8126567068
ISBN-13: 978-8126567065

Reference:
Suresh, B. N. (2018). Advanced
Java Programming: A Practical Guide to Developing Applications. Wiley India Pvt Ltd.

SYLLABUS OF MCA 3rd SEMESTER

MCA-219	Machine Learning Using Python	L T P	Cr
		3-0-0	3

COURSE OBJECTIVE: The main objective of this course is to enabling the student with basic knowledge on the techniques to build an intellectual machine for making decisions behalf of humans. This course covers the techniques on how to make learning by a model, how it can be evaluated, what are all different algorithms to construct a learning model.

PRE-REQUISITES: Knowledge of python programming and probability and statistics.

COURSE OUTCOMES
CO1: Understand the structure, syntax, and semantics of the python language.
CO2: Appreciate the importance of visualization in the data analytics solution.
CO3: Identify various machine learning algorithms and terminologies and perform data pre-
       processing using standard ML library.
CO4: Understand appropriate unsupervised learning algorithms for performing clustering
        and dimensionality reduction.
CO5: Implement probabilistic graphical models for suitable applications.

UNIT I: CONCEPTS OF PYTHON PROGRAMMING:
Python data structures, Control statements, Functions, Object Oriented programming concepts using classes, objects and methods, Exception handling, Implementation of user-defined Modules and Package, File handling in python.

UNIT II: INTRODUCTION TO MACHINE LEARNING:
Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised,
Reinforcement- The Machine Learning process.
Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets
Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance,
The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

UNIT III: SUPERVISED LEARNING:
Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis,
Logistic Regression- K-Nearest Neighbor classifier.
Decision Tree based methods for classification and Regression- Ensemble methods.

UNIT IV: UNSUPERVISED LEARNING:
Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality -Dimensionality
Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis.

UNIT V: PROBABILISTIC GRAPHICAL MODELS:
Bayesian Networks - Learning Naive Bayes classifiers-Markov Models – Hidden
Markov Models.Sampling – Basic sampling methods – Monte Carlo -Reinforcement
Learning.

TEXT-BOOKS
1.   Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and
        Hall/CRC.
2.   T. Mitchell, Machine Learning, McGraw Hill.
3.   M. Gopal, Applied Machine Learning, McGraw Hill.
4.   Sutton R. S. and Barto, A. G., Reinforcement Learning: An Introduction, The MIT
        Press (2017).

REFERENCE-BOOKS
1.   Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2.   M. Evangelia, Supervised and Unsupervised Pattern Recognition, CRC Press.
3.   G. James, D. Witten, T. Hastie, R. Tibshirani, Introduction to Statistical Learning,
        Springer.
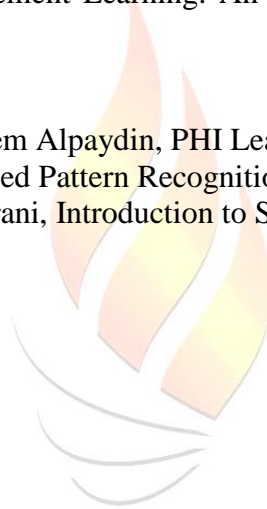
MCA-102A	RESEARCH METHODOLOGY	L	T	P	Credit
		3	1	0	4

OBJECTIVES
1. To familiarize participants with basic of research and the research process.
2. To enable the participants in conducting research work and formulating research synopsis and report.
3. To familiarize participants with Statistical packages such as SPSS/EXCEL.
4. To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the business/Research problem.

COURSE OUTCOMES
The students undergoing this course will be able to:
CO1: Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
CO2: Discuss different methodologies and techniques used in research work.
CO3: Have basic knowledge on qualitative research techniques.
CO4: Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
CO5: Propose the required numerical skills necessary to carry out research.

UNIT I
RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

UNIT II
RESEARCH DESIGN: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature.

UNIT III-Developing a theoretical framework, developing a conceptual framework, Writing about the literature reviewed. Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs

UNIT IV
DATA COLLECTION: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report,

UNITV: Layout. Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, Indian patent acts 1970. Design act 2000. The Semi-Conductor Integrated Circuits Layout Design (SICLD) Act, 2000. Copyright Act 1957. Trade Mark Act, 1999

TEXT BOOKS
1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011 Study Material.
3. Intellectual property, Debirag E. Bouchoux, Cengage learning, 2013.

REFERENCE BOOKS
1. Research Methods: the concise knowledge base Trochim, Atomic Dog Publishing, 2005.
2. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.
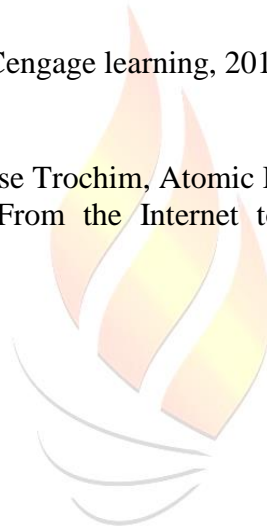
MCA-120	STATISTICAL AND NUMERICAL COMPUTING	L-T-P	Cr
		3-0-0	3

OBJECTIVE

Students will be able to understand basic theoretical and applied principles of statistics needed to enter the job force. Students will be able to communicate key statistical concepts to non-statisticians. Students will gain proficiency in using statistical software for data analysis.

PRE-REQUISITE:

This subject requires the basic knowledge of Linear Algebra and Computing. An added advantage of learning the basics of R programming first will be beneficial, as R is a language and an environment that is used for statistical computing and graphics.

COURSE OUTCOMES

CO1: To apply discrete and continuous probability distributions to various business problems.

CO2: To perform Test of Hypothesis as well as calculate confidence interval and understand the concept of p-values.

CO3: To learn non-parametric and parametric tests in order to analysis and interpret the data

CO4: To compute Bivariate and Multivariate Correlation, Regression and perform ANOVA, ANCOVA and MANOVA

UNIT I

OVERVIEW OF R: R data types and objects, reading and writing data; Control structures, functions, scoping rules, dates and times; Loop functions, debugging tools; Simulation, code profiling.

UNIT II

SOLUTION OF EQUATIONS AND SYSTEM OF SIMULTANEOUS EQUATIONS: Solution of Algebraic and Transcendental Equations using Bisection, Regula False, and Newton Raphson Methods, Gauss Elimination, Gauss Seidel, and Jacobi Methods.

UNIT III

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION, AND DIFFERENTIAL EQUATIONS: Interpolation using Lagrange, and Newton's methods, Extrapolation, Least Square Fitting, Numerical Integration using Trapezoidal, and Simpson's Rules, Numerical Solution of Ordinary Differential Equations using Euler's and Range-Kutta Methods.

UNIT IV

STATISTICS: Population, Sample, Sample Collection Methods, Data Representations and Classification, Central Tendency and Dispersion: Mean, Median and Mode, Quartiles and Percentiles, Measures of Dispersion: Range, Variance, Standard Deviation, and Coefficient of Variation. Skewness, and Kurtosis.

UNIT V

Probability and Hypothesis Testing: Sample Space, Events, Equally Likely Events, Probability, Independent Events, Addition and Multiplication Rules, Conditional Probability, Probability Distributions – Normal, Binomial, and Poison Distributions; Hypothesis Testing: Correlation using Karl Pearson and Spearman Rank Methods; Linear Regression; t-Test, Chi-Square Test, Analysis of Variance (ANOVA), Analysis of covariance (ANCOVA), Multivariate Analysis of Variance (MANOVA).

TEXTBOOK

1. M. K. Jain, S. R. K. Iyengav, and R. K. Jain: Numerical Methods for Scientific and Engineering Computation. New Age
2. Andy Field, J. Miles, and Z. Field: Discovering Statistics Using R. SAGE

REFERENCE BOOKS
S.C. Chapra & R.P.Canale: Numerical Methods for Engineering. TMH
V. Rajaraman: Computer oriented numerical methods. PHI
A. S. Grewal: Higher Engineering Mathematics. Khanna

MCA-221	CLOUD COMPUTING	L-T-P	Cr
		3-1-0	4

OBJECTIVE

It aims to provide students an overview of the field of Cloud Computing, and an in-depth study into its enabling technologies and main building blocks. Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools.

Pre-Requisites:

Knowledge of Operating Systems, Networking and Internet-scale distributed systems.

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: To know about the core concepts of the cloud computing paradigm

CO2: To Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost

CO3: To outline the role of system, network and storage virtualization.

CO4: To illustrate the fundamental concepts of cloud storage

CO5: To analyze various cloud programming models

UNIT I

BASIC CONCEPTS: The idea of concept of "cloud computing"; history of cloud computing, enabling technologies in cloud computing, advantages and disadvantages of the cloud paradigm, the economic benefits as well as issues/risks of the cloud paradigm for businesses as well as cloud providers, various layers in the cloud building block, differentiate cloud service models, SLAs and SLOs, various threats in cloud security, common cloud providers and their associated cloud stacks, popular cloud use case scenarios.

UNIT II

CLOUD INFRASTRUCTURE: Evolution of data centers*;* architecture of a modern data center, design considerations and their impact, the ability to calculate various power requirements of a data center, challenges and requirements for a cloud-centric data center, cloud software stack and the role of each layer within it, need for and techniques behind automation and orchestration of resources, programming, deployment and failure considerations when programming the cloud, implications of building a multi-tier cloud application to achieve resiliency and elasticity, and the latency implications of such applications, various cloud pricing models and their applicability to various business use cases, cloud management techniques such as middleware, resource provisioning, metering, and orchestration, different cloud software deployment considerations such as scaling strategies, load balancing, fault tolerance, accounting for tail latencies and optimizing for cost.

UNIT III

CLASSIFICATION OF CLOUD IMPLEMENTATIONS: Amazon Web Services, The Elastic Compute Cloud (EC2), The Simple Storage Service (S3), The Simple Queuing Services (SQS), Google AppEngine - PaaS, Windows Azure, Aneka, A Comparison of Cloud Computing Platforms.

UNIT IV

VIRTUALIZATION: Virtualization, Advantages and disadvantages of Virtualization, Types of Virtualization: Resource Virtualization i.e. Server, Storage and Network virtualization, Migration of processes, VMware vCloud – IaaS

UNIT V
CLOUD BASED DATA STORAGE: Introduction to Map Reduce for Simplified data processing on Large clusters, Design of data applications based on Map Reduce in Apache Hadoop, Task Partitioning, Data partitioning, Data Synchronization, Distributed File system,

Textbook:
Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, Cloud Computing: Principles and paradigms, 2011

References Books:
1. Michael Miller, Cloud Computing, Que Publishing, 2008.
2. Cloud Computing: A practical Approach Anthony Velte, Toby Velte and Robert Elsenpeter by Tata McGrawHill
3. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for dummies, 2009.
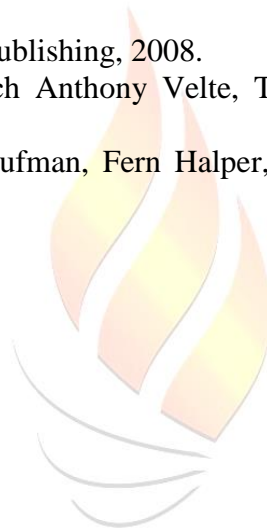
MCA-269	Machine Learning Using Python Lab	L T P	Cr
		0 0 2	1

LIST OF EXPERIMENTS

1. Installation of Python / Python Libraries.
2. Data pre-processing using Python Machine Learning libraries.
3. Design a model to predict the housing price using Multivariate Linear Regression.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
6. Build a classifier using Logistic Regression, k- Nearest Neighbor to classify whether the given user will purchase a product or not from a social networking dataset.
7. Segment a customer dataset based on the buying behavior of customers using K-means.
8. Implement the decision tree using publically available dataset.
9. Dimensionality reduction of any CSV/image dataset using Principal Component Analysis.
10. Build an email spam classifier using SVM.

TEXT-BOOKS

1. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
2. T. Mitchell, Machine Learning, McGraw Hill.
3. M. Gopal, Applied Machine Learning, McGraw Hill.
4. Sutton R. S. and Barto, A. G., Reinforcement Learning: An Introduction, The MIT Press (2017).

REFERENCE-BOOKS

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. M. Evangelia, Supervised and Unsupervised Pattern Recognition, CRC Press.
3. G. James, D. Witten, T. Hastie, R. Tibshirani, Introduction to Statistical Learning, Springer.

MCA-213	**Soft Computing**	**L-T-P** **3-0-0**

Course Objective:
This course enables the students:
1. To know the basic functions of different AI branches.
2. To understand the functionalities of neural networks .
3. To know the application of fuzzy logic.
4. To understand the basic functionalities of optimizations through soft computing.
5. To find the basic functions of soft computing.

Course Outcomes:
After the completion of this course, students will be able to:
CO1: Solve numerical on Fuzzy sets and Fuzzy Reasoning.
CO2: Develop Fuzzy Inference System (FIS).
CO3: Solve problems on Genetic Algorithms
CO4: Explain concepts of neural networks
CO5: Develop neural networks models for various applications.

UNIT – I
Introduction to Artificial Intelligence System, Neural Network, Fuzzy Logic & Genetic Algorithm. Fuzzy Set Theory: Fuzzy Versus Crisp, Crisp Set, Fuzzy Set, Crip Relation, Fuzzy Relations.

UNIT -II
Fuzzy System: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, and Applications.

UNIT – III
Genetic Algorithms, Basic Concepts, Creation Of Offspring, Working Principle, Encoding, Fitness Function, Reproduction. Genetic Modeling, Inheritance Operations, Cross Over, Inversion And Deletion, Mutation Operator, Bit Wise Operators, Generation Cycle, Convergence Of Genetic Algorithm, Application, Multi-Level Optimization, Real Life Problems, Difference And Similarities Between GA And Other Traditional Methods, Advanced In GA.

UNIT- IV
Fundamentals Of Neural Networks, Basic Concepts Of Neural Network, Human Brain, Model Of An Artificial Neuron, Neural Network Architectures, Characteristic Of Neural Networks, Learning Method, History Of Neural Network Research, Early Neural Network Architectures, MP Neurons.

UNIT – V
Back Propagation Network Architecture Of Back Propagation Network, Back Propagation Learning, Illustration, Applications, Effect Of Tuning Parameters Of The Back Propagation Neural Network, Selection Of Various Parameters In BPN, Variations Of Standard Back Propagation Algorithm. Associative Memory And Adaptive Resonance Theory, Autocorrelations, Hetrocorrelators , Multiple Training Encoding Strategy, Exponential BAM, Associative Memory For Real Coded Pattern Pairs, Applications, Introduction To Adaptive Resonance Theory.

Text Book:
1. Rajasekharan S. &Vijayalakshmi G. A. "Neural Network Fuzzy Logic and GenticAlgorithm Synthesis and Applications", Prentice Hall of India PLT, Pai, 2004.
Reference Book:
1.Jang JyhShing R, Sun C. T., Mizutani E. "Neuro Fuzzy and Soft Computing –A Computational Approach to Learning and Machine Intelligence", Prentice Hall of India, 1997.

MCA-170	STATISTICAL & NUMERICAL COMPUTING LAB	L-T-P	Cr
		0-0-2	1

COURSE OUTCOMES

CO1: Data manipulation, plot the graphs and charts with the help of computing features in R Programming.

CO2: The given data Interpretation with different distribution functions

CO3. the relevance and importance of the theory in solving practical problems in the real world

CO4: To learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.

CO5: To compute Bivariate and Multivariate Regression and Correlation and perform ANOVA and F-test.

LIST OF EXPERIMENTS

INTRODUCTION TO COMPUTING
a) Installation of R
 b) The basics of R syntax, workspace
c) Matrices and lists
d) Sub setting
e) System-defined functions; the help system
f) Errors and warnings; coherence of the workspace

GETTING USED TO R: DESCRIBING DATA
a) Viewing and Manipulating Data
b) Plotting Data
c) Reading the Data from console, file (.csv) local disk and Web
d) Working with larger datasets

VISUALIZING DATA
a) Tables, charts and plots.
b) Visualizing Measures of Central Tendency, Variation, and Shape.
c) Box plots, Pareto diagrams.
d) Find the mean, media, standard deviation and quantiles of a set of observations.
e) Note: Experiment with real as well as artificial data sets.

PROBABILITY DISTRIBUTIONS
a) Random number generation Distributions, the practice of simulation
 b) Generate and Visualize Discrete and continuous distributions using the statistical environment.
c) Demonstration of CDF and PDF uniform and normal, binomial Poisson distributions.
d) Generate artificial data using and explore various distribution and its properties. Various parameter changes may be studied.

EXPLORATORY DATA ANALYSIS
Demonstrate Range, summary, mean, variance, median, stdev, histogram, box plot, scatterplot

APPLY-TYPE FUNCTIONS

a) Defining user defined classes and operations, Models and methods in R

b) Customizing the user's environment

c) Conditional statements

d) Loops and iterations

TESTS OF HYPOTHESES

a) Perform tests of hypotheses about the mean when the variance is known.

b) Compute the p-value.

c) Explore the connection between the critical region, the test statistic, and the p-value

a) Demonstrate Statistical functions in R

b) Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modelling methods

CORRELATION

a) How to calculate the correlation between parametric and non-parametric data.

b) How to make scatter plots.

c) Use the scatter plot to investigate the relationship between two variables

T-TEST

a) Single Sample T-Test

b) Independent Sample T-Test

c) Paired Sample T-Test

Chi Square Test

a) Test for Independence

b) Goodness of Fit

ESTIMATING A LINEAR RELATIONSHIP

Demonstration on a Statistical Model for a Linear Relationship (Linear Regression)

a) Least Squares Estimates

c) Scrutinizing the Residuals

ANALYSIS of VARIANCE, ANALYSIS of CO-VARIENACE, MULTIVARIATE ANALYSIS of VARIANCE

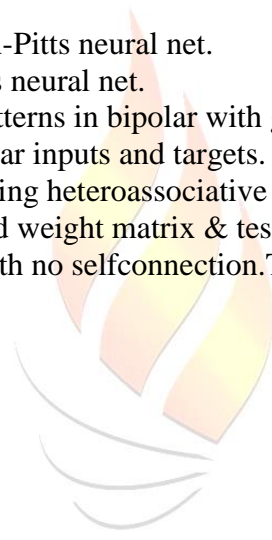a) Understating the concept, performing the test, and interpreting the results of ANOVA, ANCOVA and MANOVA

Reference Books:

1. Maria Dolores Ugarte , Ana F. Militino , Alan T. Arnholt "Probability and Statistics with R", on, CRC Press, 2 nd Edition 2016.

2. P. Dalgaard. "Introductory Statistics with R", 2nd Edition, Springer, 2008.

Web References:

1. http://nptel.ac.in/courses/110106064/

MCA-263	Soft Computing Lab	L-T-P 0-0-2

LIST OF EXPERIMENTS

1. To perform Union, Intersection and Complement operations.
 2. To implement De-Morgan's Law.
3. To plot various membership functions.
4. To implement FIS Editor. Use Fuzzy toolbox to model tip value that is given after a dinner based on quality ans service.
5. To implement FIS Editor.
6. Generate ANDNOT function using McCulloch-Pitts neural net.
7. Generate XOR function using McCulloch-Pitts neural net.
8. Hebb Net to classify two dimensional input patterns in bipolar with given targets.
9. Perceptron net for an AND function with bipolar inputs and targets.
10. To calculate the weights for given patterns using heteroassociative neural net.
11. To store vector in an auto-associative net.Find weight matrix & test the net with input
12. To store the vector ,find the weight matrix with no selfconnection.Test this using a discrete Hopfield net.

MCA-170	STATISTICAL & NUMERICAL COMPUTING LAB	L-T-P	Cr
		0-0-2	1

COURSE OUTCOMES

CO1: Data manipulation, plot the graphs and charts with the help of computing features in R Programming.

CO2: The given data Interpretation with different distribution functions

CO3. the relevance and importance of the theory in solving practical problems in the real world

CO4: To learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.

CO5: To compute Bivariate and Multivariate Regression and Correlation and perform ANOVA and F-test.

LIST OF EXPERIMENTS

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d) Working with larger datasets

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a) Tables, charts and plots.
b) Visualizing Measures of Central Tendency, Variation, and Shape.
c) Box plots, Pareto diagrams.
d) Find the mean, media, standard deviation and quantiles of a set of observations.
e) Note: Experiment with real as well as artificial data sets.

PROBABILITY DISTRIBUTIONS
a) Random number generation Distributions, the practice of simulation
 b) Generate and Visualize Discrete and continuous distributions using the statistical environment.
c) Demonstration of CDF and PDF uniform and normal, binomial Poisson distributions.
d) Generate artificial data using and explore various distribution and its properties. Various parameter changes may be studied.

EXPLORATORY DATA ANALYSIS
Demonstrate Range, summary, mean, variance, median, stdev, histogram, box plot, scatterplot

APPLY-TYPE FUNCTIONS

a) Defining user defined classes and operations, Models and methods in R

b) Customizing the user's environment

c) Conditional statements

d) Loops and iterations

TESTS OF HYPOTHESES

a) Perform tests of hypotheses about the mean when the variance is known.

b) Compute the p-value.

c) Explore the connection between the critical region, the test statistic, and the p-value

a) Demonstrate Statistical functions in R

 b) Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modelling methods

CORRELATION

a) How to calculate the correlation between parametric and non-parametric data.

b) How to make scatter plots.

c) Use the scatter plot to investigate the relationship between two variables

T-TEST

d) Single Sample T-Test

e) Independent Sample T-Test

f) Paired Sample T-Test

Chi Square Test

c) Test for Independence

d) Goodness of Fit

ESTIMATING A LINEAR RELATIONSHIP

Demonstration on a Statistical Model for a Linear Relationship (Linear Regression)

a) Least Squares Estimates

c) Scrutinizing the Residuals

ANALYSIS of VARIANCE, ANALYSIS of CO-VARIENACE, MULTIVARIATE ANALYSIS of VARIANCE

b) Understating the concept, performing the test, and interpreting the results of ANOVA, ANCOVA and MANOVA

Reference Books:

1. Maria Dolores Ugarte , Ana F. Militino , Alan T. Arnholt "Probability and Statistics with R", on, CRC Press, 2 nd Edition 2016.

2. P. Dalgaard. "Introductory Statistics with R", 2nd Edition, Springer, 2008.

Web References:

1. http://nptel.ac.in/courses/110106064/

RA-101	Reasoning & Aptitude	L T P	Cr
		1 0 0	1

UNIT 1 – Logical Reasoning – Logical Deductions (Syllogism & Venn Diagrams) logical connectives

UNIT 2- Analytical Reasoning – Seating Arrangements, combinations, selections, comparisons, blood relations, directions etc

UNIT 3 – Non – Verbal Reasoning (Alpha Numeric & Visual Puzzles) – To solve problems on numbers, alphabet, symbols, visuals, problem types and series, analogies, odd man out, coding, decoding and symbols & notations.

UNIT 4 – Higher Maths – Algebra & Mensuration

UNIT 5- Business Maths – Number system, ratios & averages, time & work, time & distance, percentages, profit & loss, simple & compound interest

UNIT 6 –Date Interpretation & Sufficiency – Tables, Bar Chart, Line Graph & Pie Chart

ELECTIVE – I

MCA-134	ELECTIVE-I COMPUTER GRAPHICS & MULTIMEDIA	L T P	Cr
		3 0 0	3

OBJECTIVE
To impart the knowledge about the different graphics, image, colour models as well as its role in real world applications

COURSE OUTCOMES
The students undergoing this course will be able to:
CO1: Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
CO2: Use of geometric transformations on graphics objects and their application in composite form. Extract scene with different clipping methods and its transformation to graphics display device
CO3: Explore projections and visible surface detection techniques for display of 3D scene on 2D screen. Render projected objects to naturalize the scene in 2D view and use of illumination models for this.
CO4: Understand the basics of computer graphics, framework for multimedia systems; multimedia devices.
CO5: Understand the basics of Multimedia graphics, different graphics systems and applications of computer graphics.

UNIT-I
INTRODUCTION: What is computer graphics, computer graphics applications, computer graphics hardware and software, two-dimensional graphics primitives: points and lines, line drawing algorithms: DDA, Bresenhem; circle drawing algorithms: using polar coordinates, Bresenhem circle drawing, midpoint circle drawing algorithm; polygon filling algorithm, boundary filled algorithm, scan-line algorithm, flood fill algorithm.
UNIT-II
TWO-DIMENSIONAL VIEWING Clipping: The 2-D viewing pipeline, windows, viewports, window to View port mapping; clipping: point, clipping line (algorithms): 4 bit code algorithm, Sutherland-Cohen algorithm, parametric line clipping algorithm (Cyrus Beck). Sutherland-Hodgeman polygon clipping algorithm
UNIT-III
2D TRANSFORMATION & 3D GRAPHICS: Homogeneous coordinates system, two dimensional transformations: transformations, translation, scaling, rotation, reflection, shearing, transformation, composite transformation. Three dimensional graphics concept, matrix, Representation of 3-D transformations, composition of 3-D transformation.
UNIT-IV
BASICS OF MULTIMEDIA TECHNOLOGY & APPLICATIONS: Computers, communication and entertainment, multimedia an introduction; framework for multimedia systems; multimedia devices; CD Audio, CD-ROM, CD-I, presentation devices and the user interface; multimedia presentation and authoring; professional development tools; Applications of environment in various fields.

UNIT-V
LAN AND MULTIMEDIA: internet, World WideWeb and multimedia distribution network: ATM & ADSL; multimedia servers and databases; vector graphics; 3D graphics programs; animation techniques; shading; anti-aliasing; morphing; video on demand.

TEXT BOOK
Computer Graphics – Donald Hearn & M.Pauline Baker, Prentice Hall of India

REFERENCES:
1.   Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
2.   Asthana, Sinha, "Computer Graphics", Addison Wesley Newman and Sproul,
3.   "Principle of Interactive Computer Graphics", McGraw Hill
4.   Steven Harrington, "Computer Graphics", A Programming Approach, 2nd Edition

MCA-132	ELECTIVE-I	L T P	Cr
	Android Programming	3 0 0	3

OBJECTIVES
- Creating robust mobile applications and learn how to integrate them with other services.
- Creating intuitive, reliable mobile apps using the android services and components.
- Create a seamless user interface that works with different mobile screens.

PRE-REQUISITES
Knowledge of Java programming language that underpins all Android development

COURSE OUTCOMES
Students after undergoing this course will be able to:

CO1: Build enterprise level mobile applications with Kotlin on Android..
CO2: Understand both the basic and advanced concepts of Kotlin..
CO3: Understand why use Kotlin over Java. Install and configure Android Studio.
CO4: Understanding the database deployment in android studio.
CO4 Deploy the application on Google Play.

.**Unit 1**
Android and its tools: Introduction to Android, open handset alliance, Android Ecosystem, Need of Android, Features of Android, Tools and software required for developing android application, android architecture. Operating systems, Java, JDK, Android SDK, Android development tools (ADT), Android virtual devices (AVDs), Emulators, Dalvik Virtual Machine, Difference between JVM and DVM, Steps to install and configure Android Studio and SDK.

Unit II
UI components and layout: Control Flow, Directory Structure Components of a screen, Fundamental UI Design Linear Layout; Absolute Layout; Frame Layout; Table Layout; Relative Layout.

Unit III
Designing user Interface with view: Text View, Edit Text; Button, Image Button; Toggle Button; Checkbox; Progress Bar, List View; Grid View; Image View; Scroll View; Custom Toast Time and Date Picker.

Unit IV
Activity and Multimedia with databases: Intent, Intent Filter, Activity Lifecycle; Broadcast Lifecycle, Content Provider; Fragments Service: Features Of service, Android platform service, Defining new service, Service Lifecycle, Permission, example of service. Android System Architecture, Multimedia framework, play audio and Video, Text to speech, Sensors, Async tasks Audio Capture, Camera Bluetooth, Animation, SQLite Database, necessity of SQLite, creation and connections of the database, extracting value from cursors, transactions.

Unit V
Security and application deployment: MS Telephony, Location Based Services: Creating the project, Getting the maps API key, Displaying the map, Displaying the zoom control, navigating to a specific location, adding markers, getting location, Geocoding and reverse Geocoding, Getting Location data, Monitoring. Android security model, declaring and using permissions, using custom permissions. Application deployment: creating small applications, signing of applications, deploying apps on google play store, become a publisher, developer console.

Text Books :
   1. Dawn Griffiths, David Griffiths "Headfirst Android Development" November 2021 O'Reilly Media, Inc.
   2. Barry Burd, "Java Programming for Android Developers for Dummies.2nd edition", Wiley.

Reference books:
mark murphy ,"The Busy Coder's Guide to Advanced Android Development" Commons Ware
John Horton "Android Programming with Kotlin for Beginners" 1st edition Packt Publishing Limited.
Michael Burton Android App Development FD 3rd edition For Dummies

MCA-217B	ELECTIVE-I .Net Framework using C#	L T P 3 0 0	Cr 3

OBJECTIVE:
Provide a consistent, object-oriented programming environment whether object code is stored and executed locally, executed locally but web-distributed, or executed remotely

PRE-REQUISITE:
Basic concepts of Programming, knowledge of HTML, CSS, Visual studio, C#.

COURSE OUTCOMES

CO1: To learn basic programming in C# and the object oriented programming concepts.
CO2: To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
CO3: To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
CO4: To implement mobile applications using .Net compact framework
CO5: To understand the working of base class libraries, their operations and manipulation of data using XML.

UNIT I
C# LANGUAGE BASICS
.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers
UNIT II
C# ADVANCED FEATURES
Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions – Reflection

UNIT III
BASE CLASS LIBRARIES AND DATA MANIPULATION
Diagnostics -Tasks, Threads and Synchronization - .Net Security - Localization - Manipulating XML- SAX and DOM - Manipulating files and the Registry- Transactions - ADO.NET- Peer-to-Peer Networking - PNRP - Building P2P Applications - Windows Presentation Foundation (WPF).

UNIT IV
WINDOW BASED APPLICATIONS, WCF AND WWF
Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services - .Net Remoting - Windows Service - Windows Workflow Foundation (WWF) - Activities – Workflows

UNIT V
.NET FRAMEWORK AND COMPACT FRAMEWORK

Assemblies - Shared assemblies - Custom Hosting with CLR Objects - Appdomains - Core XAML - Bubbling and Tunneling Events- Reading and Writing XAML - .Net Compact Framework - Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner . ―Professional C# 2012 and .NET 4.5‖, Wiley, 2012
2. Harsh Bhasin, ―Programming in C#‖, Oxford University Press, 2014.

REFRENCES:

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, ―Programming C# 4.0‖, O_Reilly, Fourth Edition, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, 2012.
3. Andy Wigley, Daniel Moth, Peter Foot, ―Mobile Development Handbook‖, Microsoft Press, 2011.

ELECTIVE- I LAB

MCA-182	ELECTIVE-I LAB (Android Programming LAB)	L T P	Cr
		0 0 2	1

COURSE OUTCOMES:

CO1: Understand the basic concepts of java and android programming.
CO2: Apply the concepts of android programming in with kotlin .
CO3: Apply clipping and filling techniques for modifying an object.
CO4: Understand the concepts database and deployment to IDE.
CO5: Understand the practical implementation and deploy the apps on Google play store.

Android Programming Lab Experiments
Basic
1. Develop a program to implement frame layout, table layout and relative layout.
2. Develop a program to implement Text View and Edit Text.
3. Develop a program to implement Auto Complete Text View.
4. Develop a program to implement Button, Image Button and Toggle Button.
5. Develop a program to implement login window using above controls.
6. Develop a program to implement Checkbox.
7. Develop a program to implement Radio Button and Radio Group.
8. Develop a program to implement Progress Bar.
9. Develop a program to implement List View, Grid View, Image View and Scroll View.
10. Develop a program to implement Custom Toast Alert.
11. Develop a program to implement Date and Time Picker.
12. Develop a program to create an activity.
13. Develop a program to implement new activity using explicit intent and implicit intent.

Intermediate

14. Develop a program to implement content provider.
15. Develop a program to implement broadcast receiver.
16. Develop a program to implement sensors.
17. Develop a program to build Camera.
18. Develop a program for providing Bluetooth connectivity.
19. Develop a program for animation.
20. Perform Async task using SQLite.

Advance
1. Write a Program How to Save ArrayList to SharedPreferences in Android?
2. How to Add Views Dynamically and Store Data in Arraylist in Android?
3. Write a Program to implement Volley Library in Android?
4. Write a Program JSON Parsing in Android
5. Write a Program JSON Parsing in Android using Volley Library
6. Write a Program How to Extract Data from JSON Array in Android using Volley Library?
7. Write a Program to Create sample application with login module. (Check username and password) On successful login, Change Text View "Login Successful". And on login fail, alert user using Toast "Login fail".

8. Write a Program to Create login application where you will have to validate username and password till the username and password is not validated, login button should remain disabled.

Mini Project

Program: How to Build a Grocery Android App?
Reference book:
1. Write a program GUI Design for Android Apps Authors Ryan Cohen, Tao Wang

ELECTIVE II

MCA-223	ELECTIVE-II (AGILE TECHNOLOGY)	L T P	Cr
		3 0 0	3

Course Objectives:
- To learn the fundamental principles and practices associated with various agile development methods.
- To learn how agile methods scale to large and distributed projects, including the role of systems engineering.

Course Outcomes (COs):
After completion of course, students would be able to:

    CO1: Understand of agile software engineering and its advantages.

    CO2: Understand software engineering standards for Agile process

    CO3: Apply agile software engineering practices over the entire software development lifecycle.

    CO4: Understand Agile Metrics Release Planning and Estimation in Scrum based software development.

    CO5: Understand Scrum Framework and its application scenarios.

Unit 1: Agile Software Development
    Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality.

Unit 2: Agile and Scrum Principles
    Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values. Agile Product Management: Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue.

Unit 3: Agile Requirements
    User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

Unit 4: Testing
    The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.

Unit 5: Agile Review
    Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile

approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, The rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools Scaling Agile for large projects: Scrum of Scrums, Team collaborations, Scrum, Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, Best Practices to Manage Scrum.

Text-Books

1. Agile Software Development, Principles, Patterns, and Practices (Alan Apt Series) Robert C.

Reference-Books

1. Succeeding with Agile: Software Development Using Scrum, Pearson 2010.

MCA-225	ELECTIVE-II (INTERNET OF THINGS)	L-T-P	Cr
		3-0-0	3

OBJECTIVE

It enables the students to describe what IoT is and how it works today, Recognise the factors that contributed to the emergence of IoT and Design and program IoT devices.

Pre-Requisites:

Basic knowledge of passive electrical & electronics components, basic programming such as C language, accessibility to the Hardware such as Arduino UNO & Arduino IDE.

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: To Use real IoT protocols for communication
CO2: To Secure the elements of an IoT device
CO3: To Design an IoT device to work with a Cloud Computing infrastructure
CO4: Transfer IoT data to the cloud and in between cloud providers
CO5: To Define the infrastructure for supporting IoT deployments

UNIT I

IOT: What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues

UNIT II

IOT PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III

IOT ARCHITECTURE:

IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

UNIT IV

WEB OF THINGS:

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

UNIT V

IOT APPLICATIONS:

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc

Textbook:
1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

References Books:
1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013 Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

MCA-227	ELECTIVE-II (E-Commerce and Applications)	L T P 3 0 0	Cr 3

OBJECTIVE:
To give the students knowledge about the e-business and transactions done electronically

PRE-REQUISITE:
Knowledge of internet and web development, data mining, computer networks, software engineering.

COURSE OUTCOMES: The students undergoing this course will be able:
CO1: To learn the basic concepts of E-commerce (EC) and its various categories
CO2: To aware about the infrastructure required in e-commerce
CO3: To know about the payment system operated electronically
CO4: To aware about e-business and e-auctions and its related aspects
CO5: To learn about e-commerce and EC support service

UNIT I
Overview of Electronic Commerce: E-Commerce Definition and Concepts, classification of e-commerce; application of e-commerce technology; ,Benefits; impact of e-commerce; business models; framework of e-commerce.; business to business; business to customer; customer to customer; advantages and disadvantages of e-commerce; electronic commerce environment and opportunities: back ground – the electronic commerce environment – electronic market place technologies.

UNIT II
NETWORK INFRASTRUCTURE OF E-COMMERCE: Network infrastructure to e-commerce & internet; LAN; Ethernet (IEEE 802.3); WAN; internet; TCP/IP reference model; domain names; internet industry structure; FTP applications; protocols required for ecommerce; HTTP; CGI 3; firewalls; securing web service; secure payment system transaction security (SET); cryptology; digital signatures

UNIT III
ELECTRONIC PAYMENT SYSTEM & EDI: Electronic Payment System Defination and Methods;Introduction to electronic cash and electronic payment schemes – internet monitory payment; different models; framework; prepaid and post-paid payment model and security requirements – payment and purchase order process – online electronic cash. Search tools: directories; search engines; Meta search engines. EDI & E-content: Business Trade Cycle; EDI; EDI Fact, Electronic content.

UNIT IV
E-BUSSINESS & E-Auctions: Business requirements – concepts; payment processing. launching your e business- marketing an e-business; public relations; consumer communication; news groups & forums; exchanging links; web rings; e-business back end systems; business record maintenance; back up procedures and disaster recovery plans.An Introduction of E-Auctions ;E-Auctions Models and Types ;Future of E-Auctions

UNIT V
M-COMMERCE, ADVERTISING & CRM: Introduction to mobile commerce; framework; applications; design methodology and advantages; future trends in m-commerce.

Supply chain management in e-commerce. Internet Advertising; Models of Internet advertising; sponsoring content; Corporate Website; Weaknesses in Internet advertising; web auctions. E-retailing; Role of retailing in E-commerce; E-marketing and advertising. CRM in e-commerce.

CASE STUDY: Discussion on a corporate web site, E-commerce legal issues & cyber laws.

TEXT BOOK

Chaffey, Dave, "E-business and E-commerce Management", Pearson Education

REFERENCE BOOKS

1. Kalakota, Ravi,Whinston Andrew B . , "E-Commerce-A Manager's guide", Addison Wesley.
2. David Whetley; E-commerce concepts.

MCA-229	ELECTIVE-II (DATA HANDLING AND VISUALIZATION)	L	T	P	Cr
		3	0	0	3

COURSE OUTCOMES
The students undergoing this course will be able to:
CO1: Design effective data visualizations in order to provide new insights
CO2: Find and select appropriate data that can be used in order to create visualization
CO3: Find and save data to IU-supported research storage for both short- and long-term preservation in order to comply with data management mandates
CO4: Handle data and data visualizations in a manner that demonstrates an understanding of ethical considerations surrounding data
CO5: Properly document and organize data and visualizations in order to prepare them for reuse.

UNIT I
INTRODUCTION TO VISUALIZATION: Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values ,Color as a Tool to Highlight, Directory of Visualizations-Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

UNIT II
VISUALIZING DISTRIBUTIONS: Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots-Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile- Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT III
VISUALIZING ASSOCIATIONS & TIME SERIES: Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series, Multiple Time Series and Dose–Response Curves, Time Series of Twoor More Response Variables

UNIT IV
VISUALIZING UNCERTIANITY: Visualizing Trends Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

UNIT V
PRINCIPLE OF FIGURE DESIGN: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

TEXT-BOOKS
Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.

REFERENCE-BOOKS

1.   Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems,Apress, 2018
2.   Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013