

DEPARTMENT OF M.C.A

**OUTCOME BASED EDUCATION SYLLABUS
CHOICE BASED CREDIT SYSTEM (CBCS)**

TWO YEARS MCA PROGRAMME

**Effective for the Students admitted from the academic year
2023 - 2024 and Onwards**



**DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(AUTONOMOUS)**

College with Potential for Excellence

Linguistic Minority Institution affiliated to University of Madras

**E.V.R. PERIYAR HIGH ROAD,
ARUMBAKKAM, CHENNAI – 600106,**

TAMILNADU

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VISION

Empower every student to be innovative, creative and productive in the domain of Computer Science by importing quality education, developing skills and inculcating human values.

MISSION

M1	To organize workshops at regular intervals to bridge the gap between the academia and industry.
M2	To enable the students to be industry ready by developing state-of-the-art curriculum in tune with industry requirements.
M3	By providing the necessary skills and to make students to excel in challenging scenario.
M4	To make students to understand the concepts using innovative teaching materials.

PROGRAMME EDUCATIONAL OUTCOMES

(PEOs)

PEO1	To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.

PROGRAMME OUTCOMES [POs] FOR POST GRADUATE

At the end of the PG programme, the student will be able:

PO1	To attain suitable scientific knowledge and technical skills to realize, calibrate and develop innovative processes / skills for creation of inventive products which are beneficial to society.
PO2	To implement discipline, professionalism, team spirit, communication skills, social and ethical commitment in the post graduates in order to embellish leadership roles expediting perfection in different sector with a categorical professional distinctiveness, business savvy, international recognition and imperishable expansion.
PO3	To be habituated with the emerging expanses of erudition and their applications in several domains of biological sciences and to enlighten the students of its relevance in forthcoming studies.
PO4	To enhance the insight of research-oriented knowledge in conjunction with literature survey, design of experimental methodology, analysis and interpretation of results and draw valid conclusions.
PO5	To provoke entrepreneurship among the students along with strong ethics and communication skills.
PO6	To engage in Lifelong learning and enduring proficient progress.

**PROGRAMME SPECIFIC OUTCOMES [PSOs] FOR
MCA**

PSO1	Understand, analyze and develop Computer Programs in the areas related to algorithms, process and solutions for specific application development using appropriate data modeling concepts.
PSO2	Design, develop, test and maintain desktop, web, mobile and cross-platform software applications using latest tools, technologies and skills and computing models and thereby enhance the ability to carry out research, experiment, contemporary issues to solve industrial problems.
PSO3	Develop skill set to communicate one's ideas effectively and to demonstrate team, work as a member/leader to solve complex computing problems and design appropriate techniques to enhance ability for life-long learning.
PSO4	Make graduates to understand cross-cultural, societal, profession, legal and ethical issues prevailing in industry.

ELIGIBILITY FOR ADMISSION

The Eligibility for Admission to First Year MCA Degree Programme is given below:

- A pass in BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree OR a pass in B.Sc./ B.Com./ B.A. with Mathematics at 10+2 level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University) and obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination (as per AICTE norms).
- Candidates should have appeared for the TANCET (MCA) Examination conducted by Anna University Chennai, Chennai 600 025 during the academic year of admission.

ASSESSMENT PATTERN

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; K2- Understand; K3- Apply; K4-Analyze; K5- Evaluate; K6-Create;

1. THEORY EXAMINATION

CIA- Continuous Internal Assessment (50

Marks) Test – I & II: 30 Marks (Theory)

Bloom's Category	Section	Description	Marks	Total
K1, K2	Part A-10 x 1 Mark [MCQ/Short answers]	Choose/Fill ups/One word	10	50
K3, K4, K5	Part B-4 (Either or Pattern) x 5 Marks	200 Words	20	
K4,K5,K6	Part C-1 (Compulsory Question) x10 Marks and 1 (Either or Pattern) x 10 Marks	500 Words	20	

Components of Continuous Internal Assessment (CIA)

Components			Calculation	CIA Total
Test	I	50	(Test1 + Test2) *0.3 = 30	50
	II	50		
Test III-Generic Skills (Group discussion/Real time Project work/Seminar/ Poster Presentation)			15	
Attendance			05	

ESE- Semester End Examination (100 Marks; Weightage is 50%)

Bloom's Category	Section	Description	Marks	ESE Total
K1, K2	Part A – 10 x 2 Marks	50 Words	20	100
K3, K4, K5	Part B– 5 (Either or pattern) x 7 Marks	300 Words	35	
K3, K4, K5, K6	Part C- One Compulsory question x 15 marks and 2 (either or pattern) x 15 marks	500 words	45	

2. **PRACTICAL EXAMINATION**

Bloom's Category	CIA (Performance and Attendance)	ESE (Record Work and Performance)	Total
K3, K4, K5, K6	50	50	100

Scheme of Examination
(For the students admitted during the academic year 2023-2024 and onwards) Under Choice Based Credit System (CBCS)

POSTGRADUATE PROGRAMME

Programme: M.C.A Applications

Branch: Computer

Part	Course Code	Study Components and Course Title	Instruction Hours/Week	Total Contact Hours	Continuous Internal Assessment (CIA)	End-Semester Examination (ESE)	Total Marks	Credits
Semester-I								
I	2329101	CORE/Relational Database Management Systems	4	60	50	50	100	4
I	2329102	CORE/Advanced Java Programming	4	60	50	50	100	4
I	2329103	CORE/Data Structures and Algorithms	4	60	50	50	100	4
I	2329104	CORE/Operating System Concepts	4	60	50	50	100	4
I	2329105	CORE/Basics of Statistics	4	60	50	50	100	4
I	2329106	CORE Practical I /RDBMS Lab	4	60	50	50	100	2
I	2329107	CORE Practical II /Advanced Java Programming Lab	4	60	50	50	100	2
II		Soft Skills-I/ Communication Skills	2	30	50	50	100	2
II	2329108	Spoken Tutorial I/ LINUX	-	-	-	-	-	1
TOTAL CREDITS FOR THE SEMESTER								27

Semester-II								
I	2329209	CORE/Python Programming	4	60	50	50	100	4
I	2329210	CORE/Mobile Application Development	4	60	50	50	100	4
I	2329211	CORE/ Cloud Computing Fundamentals	4	60	50	50	100	4
I	2329212	CORE/ Artificial Intelligence	4	60	50	50	100	4
I	2329213	ELECTIVE-I	4	60	50	50	100	4
I	2329214	CORE Practical III /Python Programming Lab	4	60	50	50	100	2
I	2329215	CORE Practical IV /Mobile Application Development Lab	4	60	50	50	100	2
II		Soft Skills-II/ Quantitative Aptitude	2	30	50	50	100	2
II	2329216	Spoken Tutorial II/ PYTHON	-	-	-	-	-	1
TOTAL CREDITS FOR THE SEMESTER								27
Semester-III								
I	2329317	CORE/Introduction to Big Data Analytics	4	60	50	50	100	4
I	2329318	CORE/R Programming	4	60	50	50	100	4
I	2329319	CORE/Machine Learning	4	60	50	50	100	4
I	2329320	ELECTIVE-II	4	60	50	50	100	4
I	2329321	ELECTIVE-III	4	60	50	50	100	4
I	2329322	CORE Practical V /Big Data Analytics Lab	4	60	50	50	100	2
I	2329323	CORE Practical VI / R Programming Lab	4	60	50	50	100	2
II	2329324	Summer Internship	-	-	-	-	-	1
II		Soft Skills-III/ Analytical Reasoning	2	30	50	50	100	2
II	2329325	Spoken Tutorial III/ GIT	-	-	-	-	-	1
TOTAL CREDITS FOR THE SEMESTER								28
Semester-IV								
I	2329426	CORE/Project Work	-	-	50	50	100	12
II	2329427	CORE/Certificate Course-SWAYAM	-	-	-	-	-	2

II		Soft Skills-IV/ Personality Development	-	30	50	50	100	2
II	2329428	Spoken Tutorial IV/ LATEX	-	-	-	-	-	1
TOTAL CREDITS FOR THE SEMESTER								17

TOTAL CREDITS FOR THE COURSE : 99 (27 + 27 + 28 + 17)

- **Part-II courses** are not included in Total Marks and CGPA Calculation.
- **Spoken Tutorial Courses** offered by IIT Mumbai through Spoken Tutorial Project MHRD Govt. of India. Online Examination will be conducted and qualified students (minimum passing percentage of 40%) will be issued certificate by IIT Mumbai. Students will submit a copy of the certificate after qualifying the online test as a proof to the COE's office to earn 1 credit for the same.
- **Summer Internship** will be carried out by the students during the summer vacation of the first year with a minimum of 3 weeks or 21 days (as per UGC guidelines) and the internship certificate should be sent to the COE office and the same will be included in the Third Semester Marks Statement to earn 1 credit.
- Students should complete any one **Certificate Course offered by Swayam Portal**, an initiative by Govt. of India (Not Less Than 8 Weeks) within the duration of the course (on or before the completion of the final semester). Students will submit a copy of the certificate issued by NPTEL after qualifying as a proof to the COE's office to earn 2 credits for the same.

Abstract of
Scheme of Examination
 (For the students admitted during the academic year 2023-2024 and onwards)

Part	Course	Papers	Credits	Total Credits	Marks	Total Marks
Part I	Core Theory	12	4	48	100	1200
	Core Practical	6	2	12	100	600
	Core Project	1	12	12	100	100
	Electives	3	4	12	100	300
PART I				84		2200
Part II	Soft Skills	4	2	8	100	400
	Spoken Tutorial	4	1	4	-	-
	Summer Internship	1	1	1	-	-
	Certificate Course	1	2	2	-	-
PART II				15		400
TOTAL				99		2600

List of Elective Papers (Can choose any one of the papers as electives)		
Component	Course Code	Course Name
Elective-I	2329213(A)	Principles of Digital Image Processing
	2329213(B)	Multimedia
	2329213(C)	Computer Networks
Elective-II	2329320(A)	Soft Computing
	2329320(B)	Network Security
	2329320(C)	Ethical Hacking
Elective-III	2329321(A)	Introduction to Internet of Things
	2329321(B)	Blockchain Technology
	2329321(C)	Green Computing

Syllabus Co-Ordinator

BOS-Chairman

Academic Council-Member Secretary

DEPARTMENT OF MCA

FIRST SEMESTER

CORE- RELATIONAL DATABASE MANAGEMENT SYSTEMS

(For Students admitted from 2023 onwards)

Course Code	: 2329101	Credits	: 04
L:T:P:S	: 3:1:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram*
- *To make a study of SQL and relational database design.*
- *To know about data storage techniques and query processing.*
- *To impart introductory knowledge on NoSQL.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain difference between file system and database system, the basic concepts of data models and its classification like ER model, relational model, network model, object oriented model and case study as ER model.
CO2	Discuss the relational database terminologies; analyze types of keys in relational database system. Understand the Relational algebra and improve the performance of database by normalization and hence the types of normal forms.
CO3	Implementation of Relational Database in Oracle SQL, analyzing of DDL, DML and DRL statements, Joins, Group functions and Integrity Constraints with syntax and examples.
CO4	Demonstrate the types of PL/SQL statements with examples and hence discuss the purpose of Cursors, Triggers, Procedures and Functions in PL/SQL with its implementation.
CO5	Analyze the types of subprograms in PL/SQL like functions and procedures. Describe how to write triggers in PL/SQL block. Explain the Transaction States and properties of Transactions.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	3	3	3
CO3	3	3	2	2
CO4	3	2	2	2
CO5	3	2	2	2

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction to Databases- Characteristics of the Database -Advantages of using DBMS - Categories of Data Models-Schemas and Instances -Three-Schema Architecture-Data Independence– Conceptual Modeling using ER Model: Entities and Attributes, Entity types and Entity sets, Relationship types, Degree of a Relationship Type, Weak Entity types, Notations for ER diagrams, Naming Conventions, An Example ER diagram.	12	CO1
2	Relational Model Concepts: Domains, Attributes, Tuples, Relations, Types of Keys- Relational Algebra: Unary Operations, Operations from Set Theory, Cartesian product, Division and Rename. Normalization: Purpose of Normalization – Functional Dependencies –First Normal Form, Second Normal Form, Third Normal Form-Boyce-Codd Normal Form (BCNF).	12	CO2
3	Basic SQL: Attribute Data types and Domains in SQL -DDL Commands- DML Commands-Select statement using where, in, between, order by, like, distinct, relational operators and logical operators- Numeric functions-Character functions -Date functions- - SQL Group functions - SQL Set Operators – Commit-Rollback- Integrity Constraints in SQL.	12	CO3
4	Nested Query-Inner Joins-Outer Joins- PL/SQL: Structure of PL/SQL Block- Decision making statements in PL/SQL-Loop Statements in PL/SQL- Cursors: Implicit Cursor- Explicit Cursor- Exception Handling: Built-in Exceptions -User-Defined Exceptions.	12	CO4
5	Subprograms in PL/SQL: Procedures and Functions- Triggers in PL/SQL: Syntax, Benefits and types of triggers- Transaction and System Concepts: Transaction States, The System Log, Commit point of a Transaction, Desirable properties of Transactions.	12	CO5

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, “**Fundamentals of Database Systems**”, 7th Edition, Pearson Education, 2017. (Units I,II,V)
2. Sharad Maheswari and Ruchin Jain, “**Introduction to SQL and PL/SQL**”, Firewall Media, 2016. (Units III,IV)

Reference Books:

1. Avi Silberschatz, Henry F. Korth and S. Sudarshan. “**Database System Concepts**”, 6th Edition, McGraw Hill.
2. Raghurama Krishnan and Johannes Gehrke, “**Data Base Management Systems**”, TMH 3rd Edition,2003
3. Majumdr, Bhattacharyya,” **Data Base Management Systems**”, TMH ,96.

E-References:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. <https://www.db-book.com/db6/slide-dir/index.html>
3. <https://beginnersbook.com/2015/04/dbms-tutorial/>
4. <https://www.technolamp.co.in/2011/09/database-management-systems-dbms-imp.html>

DEPARTMENT OF MCA

FIRST SEMESTER

CORE-ADVANCED JAVA PROGRAMMING

(For Students admitted from 2023 onwards)

Course Code	: 2329102	Credits	: 04
L:T:P:S	: 3:1:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *To provide the ability to design a console based, GUI based and web based advanced applications.*
- *Students will also be able to understand integrated development environment to create, debug and run multi-tier and enterprise-level applications*
- *To develop distributed applications*
- *Analyzing different problems in Web Applications and providing solutions*
- *Applying the knowledge to develop Web Applications for industries and individuals.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Design and implement dynamic web page with validation using JavaScript objects
CO2	Develop proficiency in creating solutions for web applications
CO3	Describe how servlets fit into Java-based web application architecture
CO4	Apply the concepts of RMI in an application
CO5	Explain the concepts and terminologies of JSP

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	2

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction to Javascript: Data types and literals –Type Casting - Variables - Java Script Array – Operators and Expressions - Java Script Programming Constructs- JavaScript Functions- Dialog boxes.	12	CO1
2	Forms used by a Website: Form object-Form object’s Methods - Different elements - Other built-in Object-User defined objects – Regular expression – Form validation.	12	CO2
3	Java Servlets: Servlet life-Cycle -Types of Servlet – Servlet Chaining -Forward Model -Include Model - Session Tracking Mechanisms -URI-Rewriting - Hidden Form Fields – Cookies- HttpSession - using JDBC in Servlets.	12	CO3
4	RMI : RMI Overview – Developing applications with RMI: Declaring & Implementing remote interfaces - stubs & skeletons - Registering remote objects - writing RMI clients –Pushing data from RMI Servlet – RMI over Inter- ORB Protocol.	12	CO4
5	JSP: JSP Overview – Advantages of JSP over Servlet - life Cycle of JSP Page - Examining MVC and JSP - JSP Scripting Elements- JSP Directives - JSP implicit objects – JSP exception – JSP action tags.	12	CO5

Text Books:

- Ivan Bayross, “**Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI**“, BPB publication”, 2111.
- J. McGovern,R. Adatia,Y. Fain, “**J2EE 1.4 Bible**”, Wiley-dreamtech India Pvt. ltd, 2013.

Reference Books:

- Thomas Powell and Fritz Schneider, "**JavaScript 2.1 The Complete Reference**", Second Edition, McGraw- Hill,2014.
- Thomas A.Powell and Fritz Schneider, “**JavaScript: The Complete Reference**”, TataMcGraw Hill, 2012.
- Patrick Naughton and Herbert Schildt, “**Java 2: The complete Reference**”, Tata-McGraw Hill Publishing, 2nd Reprint, 2011.
- Kogent Solution Inc, “**Java 6 Programming Black Book**”, Dreamtech Press, 2017.
- Jim Keogh,”**J2EE the Complete Reference**”, First Edition, Tata McGraw Hill, 2012.
- Jason Hunter and William Crawford, “**Java Servlet Programming**”, Second Edition, O'Reilly, 2011.

E-References:

- <https://www.edureka.co/blog/advanced-java-tutorial>
- <https://www.javatpoint.com/jsp-tutorial>
- <https://www.javatpoint.com/servlet-tutorial>
- <https://www.javatpoint.com/RMI>
- <https://www.javascripttutorial.net/>
- <https://www.javatpoint.com/javascript-tutorial>

DEPARTMENT OF MCA

FIRST SEMESTER

CORE-DATA STRUCTURES AND ALGORITHMS

(For Students admitted from 2023 onwards)

Course Code	: 2329103	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To impart the knowledge about the concepts of data structures and algorithms.
- To enable the students to analyze the efficiency of algorithms.
- Train the students to design and analyze linear and non-linear data structures.
- Enable the students to implement suitable data structures and algorithms in real time applications

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the types of data structures and illustrate the working of stacks, queues, linked lists as examples for the same.
CO2	Describe the types of trees, binary tree traversals and some types of trees like AVL trees and Red-Black trees.
CO3	Illustrate different types of graphs and its applications like shortest path algorithm, minimum cost spanning tree etc.
CO4	Understand the nature of algorithmic techniques like divide and conquer and greedy method.
CO5	Determine the working of dynamic programming and backtracking algorithmic procedures with examples.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 0-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction: Definition and types of Data structures- Asymptotic notations – Complexity analysis – Arrays- representation of arrays. Linked lists: Singly linked list- Circular linked lists – Doubly linked lists. Stacks: Operations on stack, array representation of a stack, Applications – Conversion of Infix to Postfix Notation- Evaluation of Postfix expression - Queues: Operations on queues - Circular queues.	12	CO1
2	Trees – Basic terminologies, Binary Trees – Binary Tree Representations using array and linked lists-Binary Tree Traversals: Inorder, preorder and postorder— Binary Search Trees – Threaded Binary Trees- AVL Trees-Red- Black Trees.	12	CO2
3	Graphs: Representation of Graphs – Graph Implementation – Graph Traversals: BFS, DFS- Applications: Single-Source Shortest Path Problem using Dijkstra’s algorithm, Minimum Cost Spanning Trees by Kruskal’s algorithm– All Pair Shortest Path Problem using Floyd’s algorithm.	12	CO3
4	Divide and Conquer: General Method- Quick sort, Merge sort, Binary Search- Greedy Method: General Method – Optimal Storage on Tapes, Job Sequencing using Deadlines.	12	CO4
5	Dynamic Programming: General Method- Multistage Graphs, 0/1 Knapsack- Back Tracking: General Method – Graph Coloring, Sum of Subsets.	12	CO5

Text Books:

1. G A Vijayalakshmi Pai, “Data Structures and Algorithms: Concepts - Techniques and Applications”, TMH, 2008.
2. Anuradha A. Puntambekar, “**Design and Analysis of Algorithms**”, Second Edition, 2018, Technical Publications

Reference Books:

1. E.Horowitz, S. Sahni and Mehta, “**Fundamentals of Data Structures in C++**”, Galgotia Publishers, 2000.
2. E. Horowitz, S. Sahni and S. Rajasekaran, “**Computer Algorithms**”, Galgotia Publishers, 2001.
3. G. L. Heileman, “**Data Structures, Algorithms and Object Oriented Programming**”, Revised Edition, TMH, 1999.
4. A.V. Aho, J.E. Hopcroft, J.D. Ullmann, “**The Design and Analysis of Computer Algorithms**”, Pearson Education Asia, Addison Wesley Publishers, 2006.
5. S.K. Basu ,”**Design Methods and Analysis of Algorithms**”, Fourth Edition ,2013.
6. Kruse R.L, Leung B.P, Tondo C.L,” **Data Structures and Program design in C**”, Pearson, Second Edition, 2007

E-References:

1. <https://nptel.ac.in/courses/106/102/106102064/>
2. <https://www.programiz.com/dsa>
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
4. <https://www.javatpoint.com/daa-tutorial>

DEPARTMENT OF MCA

FIRST SEMESTER

CORE-OPERATING SYSTEM CONCEPTS
(For Students admitted from 2023 onwards)

Course Code	: 2329104	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To be aware of the evolution and fundamental principles of operating system, processes and their communication
- To understand the various operating system components like process management, memory management
- To know about file management and the distributed file system concepts in operating systems
- To be aware of components of operating system with relevant case study.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Defining the need of operating system components and evolution, its architecture and different types of system calls. Introduce the concept of process, operations and scheduling and thereby explain the concept of process scheduling, CPU scheduling criteria and algorithms.
CO2	Acquire the knowledge of process synchronization and illustrate the critical section problems and ways to handle the dead lock problems with the help of algorithms.
CO3	Explain and discuss the background of memory with segmentation and paging techniques and the virtual memory management with various page replacement algorithms
CO4	Sketch out the various storage structures with different disk scheduling algorithms. Describe file management with file organization, file access methods, B-trees, and File System security.
CO5	Explain how a Linux server can be integrated within a multi-platform environment.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2
CO2	3	2	1	2
CO3	3	2	2	2
CO4	3	2	3	2
CO5	2	1	3	2
CO6	3	1	2	2

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Introduction: Types of operating systems-operating systems services-System calls- Systems programs-Process Management: Process concept-Process Scheduling- Operation on Processes-Co-Operating Processes-Interprocess Communications-CPU Scheduling: Scheduling Criteria-Scheduling algorithms.	12	CO1
2	Process Synchronization –Critical Section Problem – Semaphores-Classical problems of synchronization-Deadlock Characterization-Deadlock Prevention-Deadlock avoidance-Deadlock Detection-Deadlock Recovery.	12	CO2
3	Memory Management-Swapping-Contiguous Memory Allocation-Paging-Segmentation- Virtual Memory-Demand paging-Page Replacement-Thrashing.	12	CO3
4	Disk Structures-Disk Scheduling Algorithms-File Systems Organization-File concepts-File Operations-Access methods-Directory Structures-File System Implementation-Directory Implementation-Allocation Methods-Free Space management.	12	CO4
5	History of Linux- Properties of Linux-Linux Commands-Overview of the Linux file system- Manipulation of files –File Security.	12	CO5

Text Book:

1. Abraham Silberschalz Peter B Galvin, G.Gagne, “**Operating Systems Concepts**”, 9th Edition, John Wiley & Sons, 2013.

Reference Books:

1. Andrew S.Tanenbaum, “**Modern operating Systems**”, Third Edition, PHI Learning Pvt. Ltd., 2008.
2. D M Dhamdhere, “**Operating Systems: A Concept-based Approach**”, Second Edition, Tata McGraw-Hill Education, 2007.
3. H M Deital, P J Deital and D R Choffnes, “**Operating Systems**”, 3rd edition, Pearson Education, 2011.
4. William Stallings, “**Operating Systems: Internals and Design Principles**”, Seventh Edition, Prentice Hall, 2011.

E-References:

1. https://www.tutorialspoint.com/operating_system/index.htm
2. <https://www.javatpoint.com/os-tutorial>
3. <https://nptel.ac.in/courses/106/105/106105214/>

DEPARTMENT OF MCA

FIRST SEMESTER

CORE-BASICS OF STATISTICS
(For Students admitted from 2023 onwards)

Course Code : 2329105	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- To provide an understanding of the statistical methods and probabilistic concepts by which real- life problems are analyzed (Focus on problems- No derivations)
- To develop the students ability to deal with numerical and quantitative issues
- To enable the use of statistical, graphical and algebraic techniques wherever relevant.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Recall the concepts of sample spaces, events, axiomatic approach, conditional probability, Baye's theorem. Summarize the random variables, expectation and variance. Demonstrate the Chebyshev's inequality.
CO2	Distinguish Discrete and continuous distributions. Solve the real time problems involving various distributions like Binomial, Poisson and normal distributions. Explain the concept of Bivariate analysis and point out the importance of correlation analysis, Regression analysis and various curves using method of least squares.
CO3	Summarize the concept of sampling and various methods of sampling. Point out the various errors such as standard error, type I error, type II error. Explain the Null Hypothesis and alternative hypothesis. Point the importance of estimation.
CO4	Differentiate large and small samples. Compare the various parametric tests like Z-test, t-test, F test by giving practical examples. Explain the non-parametric chi square test with illustrated examples
CO5	Restate the analysis of variance and classify the one way and two classifications. Categorize the computing randomized design and randomized block design. Define time series and list the components of time series. Illustrate the measurement of trend and seasonal variations.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	1	2
CO3	3	3	1	2
CO4	3	2	1	3
CO5	3	2	2	2

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Sample spaces - Events - Axiomatic approach to Probability - Conditional Probability - Independent Events - Baye's Formula - Random Variables - Continuous and Discrete Random Variables - Distribution Function of a Random Variables - Expectation, Variance - Coefficient of Variation - Chebyshev's Inequality.	12	CO1
2	Bivariate Distribution – Conditional and Marginal Distributions – Discrete Distributions: Discrete, Uniform, Binomial, Poisson and Geometric Distributions – Continuous Distributions: Uniform, Normal, Exponential and Gamma Distributions (only simple problems).	12	CO2
3	Correlation: Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coefficient of Correlation - Rank Correlation. Regression Analysis: Simple Linear Regression - Regression Equations.	12	CO3
4	Concepts of Sampling Distributions and Standard Error - Point Estimation (Concepts Only) - Interval Estimation of Mean and Proportion. Tests of Hypotheses - Critical Region - Two Types of Errors - Level of Significance - Power of the Test - Large Sample Tests for Mean and Proportion - Exact Tests Based on Normal, t, f and Chi-Square Distributions.	12	CO4
5	Basic Principles of Experimentation – Analysis of Variance – One Way and Two Way Classifications – Computing Randomized Design – Randomized Block Design.	12	CO5

Text Book:

1. Gupta S.C and Kapoor V.K, “**Fundamentals of Mathematical Statistics**”, 11th Edition, Sultan Chand & Sons, India, 2007.

Reference Books:

1. P.R.Vital, “**Mathematical Statistics**”, Margham Publication, 2004.
2. T.K.V. Iyengar, “**Probability & Statistics for MCA**”. S. Chand & company, New Delhi, 2009 edition.
3. Trivedi, K.S, “**Probability and Statistics with Reliability, Queuing and Computer Science Applications**”, Prentice Hall India, 1994.
4. James T. McClave and Terry Sincich, “**Statistics**”, 12th Edition, Pearson Education, India, 2013.
5. Erwin Miller and John E.Freund, “**Probability and Statistics for Engineers**”, 7th Edition, Pearson Education, India, 2017.

E-References:

1. <https://nptel.ac.in/courses/111/105/111105041/>
2. <https://nptel.ac.in/courses/111/105/111105043/>
3. <https://nptel.ac.in/courses/110/106/110106064/>

DEPARTMENT OF MCA

FIRST SEMESTER

CORE PRACTICAL I-RDBMS LAB
(For Students admitted from 2023 onwards)

Course Code : 2329106	Credits	: 02
L:T:P:S : 0:0:4:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *To explain basic database concepts, applications, data models, schemas and instances.*
- *To demonstrate the use of constraints and relational algebra operations.*
- *Describe the basics of SQL and construct queries using SQL.*
- *To emphasize the importance of normalization in databases.*
- *To facilitate students in Database design*

Lab Exercises:

1. DDL Statements
2. DML Statements
3. SELECT statement
4. Numeric functions
5. Character functions
6. Date functions
7. Group Functions
8. Set Operations
9. Nested query
10. Joins
11. Commit and Rollback
12. PL/SQL-Decision Making statements
13. PL/SQL-Looping statements
14. PL/SQL-Cursors
15. PL/SQL-Exception Handling
16. PL/SQL-Functions
17. PL/SQL-Procedures
18. PL/SQL-Triggers

DEPARTMENT OF MCA

FIRST SEMESTER

**CORE PRACTICAL II- ADVANCED JAVA
PROGRAMMING LAB**

(For Students admitted from 2023 onwards)

Course Code	: 2329107	Credits	: 02
L:T:P:S	: 0:0:4:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *The course covers Graphical User Interface (GUI) networking, JavaScript and database*
- *Student will be able to use advanced technology in Java such as Remote method Invocation , JSP.*
- *Student will be able to develop web application using Java Servlet.*

Lab Exercises:

1. Design a form and implement java script showing all the major form validations.
2. JavaScript program illustrating the Date and Math Objects
3. JavaScript program to handle different events.
4. Basic Servlet Programming
5. Servlet Collaboration-Request Dispatcher
6. Session Management and Implementation of Cookies using Servlet
7. Developing a web application with MySQL Database using Servlet
8. Designing online applications with JSP
9. Creating Web services with RMI.

DEPARTMENT OF MCA

FIRST SEMESTER

SOFT SKILLS-I COMMUNICATION SKILLS

(For Students admitted from 2023 onwards)

Course Code : 2350108	Credits	: 02
L:T:P:S : 2:0:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Unit-1: Concept of Communications

Introduction: Definition and Process of Communication - Forms of Verbal and Non-verbal Communication. Barriers of Communication: Communication Barriers and Overcoming Communication Barriers - Guidelines for Effective Communication. Business Writing: Direct and Indirect approaches to Business Writing - Five Main Stages of Writing Business Messages. **Exercise: Role Play, Square Talk Activity.**

Unit-II: Written Business Communication

External Communication: The Seven C's of Letter writing - Kinds of Business Letters - Business Reports and Proposals - Purpose of Business Reports. Internal Communication: Format and Principles of Writing Memos - General Warning - Cautions. **Exercise: Preparation of Reports on different issues.**

Unit-III: Oral Communication

Public Speaking: Types of Public Speaking - importance of Public Speaking. Power Point Presentation: Planning the Presentation - Delivering the Presentation - Developing & Displaying Visual Aids - Handling Questions from the Audience. Listening: Definition - Types of Listening Skills - Features of a Good Listener - Causes and effects of Poor Listening. **Exercise: Elocution and Extempore**

Unit-IV: Behavioral Techniques

Body Language: Facial Expressions - Body Posture - Gestures - Eye Movement - Touch and the use of Personal Space. Business Attire and Grooming: Different types of Attire - Guidelines for Business Attire. **Exercise: Power of Body Language, Charades.**

Unit-V: Etiquettes

Etiquettes: Greeting Etiquette - Corporate Etiquette - Telephone Etiquette - E-mail Etiquette - Meeting Etiquette - Netiquette - Personal Etiquette - Social Etiquette - Dining Etiquette. **Exercise: Introduction and Art of Conversation, Telephonic Activity.**

Reference Books:

1. Meenakshi Raman and Prakash Singh, "**Business Communication**", Oxford
2. Lesikar, "**Basic Business Communication**", TMH
3. David Irwin, "**Effective Business Communications**", Viva- Thorogood.
4. Rajendra Pal, J S Korlaha, "**HI:Essentials of Business Communication**", Sultan Chand & Sons, New Delhi.

*******End of First Semester*******

DEPARTMENT OF MCA

SECOND SEMESTER

CORE-PYTHON PROGRAMMING
(For Students admitted from 2023 onwards)

Course Code	: 2329209	Credits	: 04
L:T:P:S	: 3:1:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.
- To understand the wide range of programming facilities available in Python covering graphics, GUI, data visualization and Databases.
- To utilize high-performance programming constructs available in Python to develop solutions in real life scenarios.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Examine Python syntax and semantics and be fluent in the use of Python basic operations.
CO2	Create, run and manipulate Python Programs using conditional statements, loops and core data structures like strings, lists, dictionaries, tuples and sets. Illustrate the working of modules in Python.
CO3	Evaluate the concepts of Object-Oriented Programming using Python, database connection and file handling.
CO4	Discover the capabilities of numpy, scipy and matplotlib for scientific programming.
CO5	Implement exemplary applications related to Pandas and DataFrames in Python.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Basics of Python: History, Features, Data Types, Comments, Indentation, Keywords, Constants, Identifiers, Expressions, Statements and Operators- Conditional Statements-Iterative statements.	12	CO1
2	Data Structures: Lists - Tuples – Sets-Dictionaries. Functions: Types of functions, Arguments and Return values-Strings – Modules-File Handling.	12	CO2
3	Object Oriented Programming: Classes - Objects - Inheritance - Polymorphism- Exception Handling. Interacting with Databases: Introduction to MySQL -Interacting with MySQL - Building an address book and student database with add/edit/delete/search features.	12	CO3
4	Arrays in Python, 2D Numpy arrays, Numpy basic Statistics. SciPy: ScipyLinalg, Scipy Optimize. Matplotlib: Introduction, Simple plots, Figures and Sub plots.	12	CO4
5	Introduction to Pandas: Creation of Series- Operations-Creation of Dataframes- Operations-Import/Export of different types of Files- Slicing - Filtering- Groupby-Aggregation-Simple plot using pandas-Real time Case Study.	12	CO5

Text Books:

1. Allen B. Downey, “**Think Python: How to Think Like a Computer Scientist**”, O'Reilly.
2. Vamsi Kurama, “**Python Programming: A Modern Approach**”, Pearson Education.
3. R. Nageswara Rao, “**Core Python Programming**”, 2nd Edition, Dreamtech.

Reference Books:

1. Mark Lutz, “**Learning Python**”, Orielly
2. W.Chun, “**Core Python Programming**”, Pearson.
3. Kenneth A. Lambert, “**Introduction to Python**”, Cengage.
4. Pooja Sharma, “**Programming in Python**”, BPB Publications, 2017.
5. A. Martelli, A. Ravenscroft, S. Holden, “**Python in a Nutshell**”, Oreilly.

E-References:

1. <https://nptel.ac.in/courses/106/106/106106182/>
2. <https://nptel.ac.in/courses/106/106/106106145/>
3. <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs36/>
4. <https://www.tutorialspoint.com/python/>
5. <https://www.udacity.com/course/introduction-to-python>

DEPARTMENT OF MCA

SECOND SEMESTER

CORE-MOBILE APPLICATION DEVELOPMENT

(For Students admitted from 2023 onwards)

Course Code	: 2329210	Credits	: 04
L:T:P:S	: 3:1:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To introduce Android platform and its architecture.
- To learn activity creation and Android UI designing.
- To be familiarized with Intent, Broadcast receivers and Internet services.
- To work with SQLite Database and content providers.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define Android applications, download and install Android Studio, work in development environment and to execute the First Android Application. Illustrate the use of activities, fragments and intents in Android to invoke Built-in Applications and use of notification in Android.
CO2	Design and implement the user interfaces using basic widgets, views, view groups and layouts of Android.
CO3	Work with user interface to handle pictures and menus and explain data storage options using the internal and external storage using Shared Preferences, files, SQLite database and Content Providers.
CO4	Illustrate the formation of SMS and E-mail in the mobile phones and demonstrate the Location Based Services (LBS) and consumption of Web Services in Android using JSON and Sockets.
CO5	Developing Android Services by establishing communication between a service and an activity and illustrating the steps for publishing Android applications.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2
CO2	3	2	2	3
CO3	3	3	2	2
CO4	3	3	2	3
CO5	3	3	3	2

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction to Android – Features of Android-Architecture of Android-Obtaining the Required Tools- Creating First Android Application - Anatomy of Android Application- Components of Android Application-Lifecycle of Activity. Intents: Creating Intents, Types of Intents, Intents returning result, Intent Filters, Calling Built-In Application Using Intents and Displaying Notifications using PendingIntent. Fragments: Lifecycle of Fragment, Types of Fragments and how to create and use fragments.	12	CO1
2	Screen Layouts: Linear, Table, Relative, Absolute and Grid. Basic Views: Toast, TextView, EditText, Button, AutoCompleteTextView, CheckBox, ToggleButton, ImageButton, RadioButton, SeekBar, ListView, ImageView, DatePicker and TimePicker- Adapting to Display Orientation - Creating the views programmatically.	12	CO2
3	Menus: OptionsMenu, ContextMenu and PopUpMenu. Data Persistence: Saving and Loading using Shared Preferences - Persisting Data to Files - SQLite Database: Create, Insert, Delete, Update and Select queries. Content Provider: Creating and using Content Provider.	12	CO3
4	Sending SMS - Sending E-Mail- Location – Based Services: Displaying Maps - Getting Location Data. Networking: Consuming Web Services Using HTTP - Consuming JSON Services - Sockets Programming.	12	CO4
5	Developing Android Services: Lifecycle of Service, Types of service and Creating own services. Threading: Worker thread and Async thread. Publishing Android Applications: Preparing for Publishing - Deploying APK Files.	12	CO5

Text Book:

1. J.F. DiMarzio, “**Beginning Android Programming with Android Studio**”, 4th Edition, Wiley Publications, 2017.

Reference Books:

1. Wei Meng Lee, “**Beginning Android 4 Application Development**”, Wiley Publications, 2013.
2. Anubhav Pradhan, Anil V Deshpande, ‘Mobile Applications Development’, First Edition.
3. Barry Burd ‘Android Applications Development all in one for Dummies’, First Edition.
4. “Teach Your self Android Application Development in 24 hours” First Edition, SAMS.
5. Rick Boyer, “**Android 9 Development Cookbook**”, 3rd Edition, Packt Publishing, 2018.
6. Reto Meier and Ian Lake, “**Professional Android**”, 4th Edition, Wiley Publishers.

E-References:

1. <http://developer.android.com/>
2. <https://www.tutorialspoint.com/android/index.htm>
3. <https://abhiandroid.com/>

DEPARTMENT OF MCA

SECOND SEMESTER

CORE-CLOUD COMPUTING FUNDAMENTALS

(For Students admitted from 2023 onwards)

Course Code : 2329211	Credits : 04
L:T:P:S : 4:0:0:0	CIA Marks : 50
Exam Hours : 03	ESE Marks : 50

Course Objectives:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To understand the concept of Virtualization and design of cloud Services
- To have knowledge on the various issues in cloud computing
- To understand the usage of cloud in various applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the core concepts of the cloud computing paradigm: Evolution, need, advantages, limitations and factors that affect cloud computing.
CO2	Analyze the difference between grid and cloud architecture, different service models and deployment models
CO3	Develop the ability to understand virtualization technology used in cloud
CO4	Gain knowledge of various security techniques used in cloud computing
CO5	Analyze the importance of cloud in various applications

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

SI No.	Contents of Module	Hrs	COs
1	Overview of Cloud Computing: Introduction – Essentials of Cloud Computing – Needs of Cloud Computing- History of Cloud Computing- Benefits of Cloud Computing – Limitations of Cloud Computing- Vendors of Cloud Computing- Elastic Computing- Social Networking- Enterprise Cloud Computing. Factors that affect cloud computing: Cloud Data center requirements- Influence of Cloud Computing on Business Companies.	12	CO1

2	Cloud Computing Architecture: Introduction- Grid architecture- Cloud Computing Architecture –Similarities and differences between grid and cloud computing- Characteristics of Cloud Computing. Models of cloud computing – Cloud service models – cloud computing sub services models- cloud deployment models.	12	CO2
3	Cloud Data Center: Introduction – Cloud data center elements – Storage network technologies. Virtualization Technology: Introduction – virtualization reference model – advantages of virtualization- server/compute virtualization – Need and advantage of Server/compute virtualization- Techniques of server/compute virtualization- types of virtualization- exploring network virtualization - tools used in network virtualization – benefits of network virtualization - Understanding desktop virtualization – techniques used for desktop virtualization – Components used for desktop virtualization.	12	CO3
4	Security issues of Cloud Computing: Introduction – security concerns of cloud computing – cloud information security objectives- cloud security design principles – cloud security services – secure cloud software testing – cloud architectural consideration-VM security Recommendations-Challenges to cloud security. Advanced technologies in Cloud Computing: Security clouds – app-specific cloud- mobile cloud computing – Bigtable – cloud usage for big data analytics and IoT.	12	CO4
5	Case Studies: Cloud for Manufacturing Industry – Cloud for Healthcare – Cloud for Education – cloud for energy systems – cloud for transportation systems- Live video streaming APP.	12	CO5

Text Books:

1. Shailendra Singh, “**Cloud Computing**”, Oxford University Press,2018.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "**Distributed and Cloud Computing, From Parallel Processing to the Internet of Things**", Morgan Kaufmann Publishers, 2012

Reference Books:

1. Barrie Sosinsky,” **Cloud Computing Bible**”, Wiley Publishing Inc, 2013.
2. John W.Rittinghouse and James F.Ransome, “**Cloud Computing: Implementation, Management, and Security**”, CRC Press, 2010.
3. Michael Miller, “**Cloud Computing Web Based Applications that change the way you work and collaborate online**”, Pearson Education,2019.
4. Brian J.S. Chee and Curtis Franklin Jr, “**Cloud Computing Technologies and Strategies of the Ubiquitous Data Center**”, CRC Press,2010
5. Arshdeep Bahga and Vijay Madisetti,” **Cloud Computing: A Hands on Approach**”, University Press, Hyderabad, 2014.

E-References:

1. <https://nptel.ac.in/courses/106/105/106105167/>
2. https://www.tutorialspoint.com/cloud_computing/index.html
3. <https://www.guru99.com/cloud-computing-for-beginners.html>
4. <https://www.youtube.com/watch?v=LICA-ILkO4w>

DEPARTMENT OF MCA

SECOND SEMESTER

CORE-ARTIFICIAL INTELLIGENCE
(For Students admitted from 2023 onwards)

Course Code : 2329212	Credits : 04
L:T:P:S : 3:1:0:0	CIA Marks : 50
Exam Hours : 03	ESE Marks : 50

Course Objectives:

- To introduce the fundamental concepts of artificial intelligence.
- To equip students with the knowledge and skills in logic programming using Prolog.
- To explore the different paradigms in knowledge representation and reasoning.
- To understand the contemporary techniques in machine learning

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the fundamental understanding of the history of artificial intelligence (AI) and its foundations.
CO2	Explain the awareness of informed search and exploration methods
CO3	Demonstrate about AI techniques for knowledge representation, planning and uncertainty management.
CO4	Develop knowledge of decision making and learning methods.
CO5	Apply the concepts of AI in the field of NLP and Robotics

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2
CO2	3	2	2	3
CO3	3	3	2	2
CO4	3	3	2	3
CO5	3	3	3	2

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	INTRODUCTION: Intelligent Agents – Agents and environments – Good behavior – The nature of environments – Structure of agents – Problem Solving – problem solving agents – example problems – search Algorithms – Uninformed search strategies – Informed (Heuristic) Search Strategies – Heuristic Functions.	12	CO1

2	SEARCHING TECHNIQUES: Local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments – Constraint satisfaction problems (CSP) – Backtracking search and Local search – Structure of problems – Adversarial Search and Games: Optimal decisions in games – Alpha – Beta Tree search – Monte Carlo Tree Search – Stochastic games - Partially Observable Games.	12	CO2
3	KNOWLEDGE REPRESENTATION: First order logic - syntax and semantics of first order logic – Using First Order Logic - Knowledge engineering in First Order Logic – Inference – propositional versus first order Inference – unification and First Order Inference – forward chaining – backward chaining – Resolution – Knowledge representation: Ontological Engineering – Categories and objects – Events – Mental Objects and Model Logic.	12	CO3
4	LEARNING: Learning from Examples: forms of learning – Supervised learning - Learning decision trees – Ensemble learning – Knowledge in learning: Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods – Learning with complete data – Learning with hidden variable – EM algorithm – Learning Algorithms – Reinforcement learning: Passive reinforcement learning – Active reinforcement learning – Generalization in reinforcement learning.	12	CO4
5	APPLICATIONS: Natural Language Processing: Language Models - Grammar – Parsing - Augmented grammars – Robotics: Robots – Robot Hardware – Kind of Problems in Robots – Robotic Perceptions – Planning and Control – Planning Uncertain movements – Reinforcement Learning in Robotics – Humans and Robots – Robotic Frameworks.	12	CO5

Text Books:

1. Stuart Russell and Peter Norvig, 2022, “**Artificial Intelligence – A Modern Approach**”, 4th Edition, Pearson Education / Prentice Hall of India.
2. Nils J. Nilsson, 2000, “**Artificial Intelligence: A new Synthesis**”, Harcourt Asia Pvt. Ltd.

Reference Books:

1. Elaine Rich and Kevin Knight, 2003, “**Artificial Intelligence**”, Second Edition, Tata McGraw Hill.
2. George F. Luger, 2002, “**Artificial Intelligence-Structures and Strategies for Complex Problem Solving**”, Pearson Education / Prentice-Hall of India.

E-References:

1. https://en.wikipedia.org/wiki/Artificial_Intelligence:_A_Modern_Approach
2. <https://www.pearson.com/en-ca/subject-catalog/p/artificial-intelligence-a-modern-approach/P200000003500/9780137505135>

DEPARTMENT OF MCA

SECOND SEMESTER

**ELECTIVE 1-PRINCIPLES OF DIGITAL IMAGE
PROCESSING**

(For Students admitted from 2023 onwards)

Course Code	: 2329213(A)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To provide the basic knowledge on image processing techniques like image acquisition, enhancement, transform, segmentation, object recognition in images and their applications.
- To impart the mathematical logic behind the various image processing algorithms
- To facilitate the students apprehend and implement various image processing algorithms.
- To impart the performance of the algorithms with real time applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand and analyze the problems in the formation of various types of images
CO2	Analyze the need for image transforms, different types of image transforms and their properties
CO3	Analyze different techniques employed for the enhancement of images using filters
CO4	Implement different segmentation technique.
CO5	Analyzing and extracting suitable features for classification of objects. Familiar with the use of Python and OpenCV for Image Analysis

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Introduction – Steps in Digital Image Processing, Components of an Image Processing System – Image sensing and acquisition, Image Sampling and Quantization: Basic Concepts, Representing Digital Images, Basic Relationships between pixels. – color models – Basics of color image processing	12	CO1
2	Intensity Transformations and Spatial Filtering: Some basic gray level transformation functions – Histogram Processing – Fundamentals of Spatial Filtering – Smoothing Spatial Filters.	12	CO2
3	Filtering in the Frequency Domain – The Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Low-pass Frequency Domain, Image Sharpening Using High-pass Filters.	12	CO3
4	Image Segmentation: Fundamentals – Point, Line and Edge Detection-Thresholding , Segmentation by Region Growing and by Region Splitting and Merging. Feature Extraction: Boundary Pre-processing – Boundary Features Descriptors – Region Features Descriptors – Principal Components as Feature Descriptors.	12	CO4
5	Image Pattern Classification: Patterns and Pattern Classes, Pattern Classification by Prototype Matching: Minimum Distance Classifier, Correlation For 2-D Prototype Matching. Case Study: Performing image pre-processing using enhancement methods, Implementing Segmentation techniques and Classifying objects using Python, ML libraries and predefined models.	12	CO5

Text Book:

1. Rafael.C. Gonzalez, Richard.E.Woods, “**Digital Image processing**”, Fourth Edition, Pearson Education Limited, 2018.

Reference Books:

1. A.K. Jain, “**Fundamentals of Digital Image Processing**”, PHI, 2011
2. Mark Nixon, Alberto Aguado, “**Feature Extraction and Image Processing**”, Second Edition, Elsevier, 2008.
3. S. Jayaraman, S. Esakkirajan, T. Veerakumar, “**Digital Image Processing**”, Mc-Graw Hill, 2012 .
4. Himanshu Singh, “**Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python**”, Apress, 2019

E-References:

1. <http://www.nptel.iitm.ac.in/video.php?subjectId=117105079>
2. <https://docs.opencv.org/>
3. https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_tutorials.html
4. <https://scikit-image.org/>
5. <https://github.com/Gogul09/image-classification-python>

DEPARTMENT OF MCA

SECOND SEMESTER

ELECTIVE 1- MULTIMEDIA

(For Students admitted from 2023 onwards)

Course Code	: 2329213(B)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *This course aims to introduce the fundamental elements of multimedia.*
- *It will provide an understanding of the fundamental elements in multimedia.*
- *The emphasis will be on learning the representations, perceptions and applications of multimedia.*
- *Software skills and hands on work on digital media will also be emphasized.*
- *On completion of the subject, the students will understand the technologies behind multimedia applications and master the skills for developing multimedia projects.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Describe the types of media and define multimedia system.
CO2	Identify different file formats for image and audio
CO3	Explain about digital video standards, formats and technology
CO4	Examine basic principles behind animation and its techniques
CO5	Understand the functionality and technology of augmented reality

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	2	3	2	3
CO3	3	2	3	2
CO4	3	3	3	3
CO5	3	2	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Multimedia Overview: Introduction, Multimedia presentation and production, characteristics of a multimedia presentation, Multiple media, Hardware and software requirements, Uses of multimedia, steps for creating multimedia presentation.	12	CO1
2	Image: Introduction, Image Types, color models, Basic steps for Image processing, Image processing software, File formats, Image output on monitor, Image output on printer. Audio: Introduction, Fundamentals Characteristics of sound, Elements of Audio systems, Musical Instrument Digital Interface(MIDI), Audio File format.	12	CO2
3	Video: Introduction, Analog video camera, Transmission of video signals, Video signal format, Digital video, Digital Video Standards, PC Video, Video File Format, Video editing, Video editing software.	12	CO3
4	Animation: Introduction, uses of animation, key frames and Tweening, Types of animation, Computer Assisted Animation, Creating movements, Principle of animation, some Techniques of Animation, Animation on the web, 3D Animation, Special Effects, Creating Animation, Animation software.	12	CO4
5	Augmented and Mixed Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.	12	CO5

Text Books:

1. Ranjan Parekh, “**Principles of Multimedia**”, The Tata McGraw Hill, Sixth Reprint 2008.
2. Alan B. Craig, “**Understanding Augmented Reality, Concepts and Applications**”, 2013.

Reference Books:

1. Li & Drew, “**Fundamentals of Multimedia**”, Pearson Education, 2009.
2. Tay Vaughan, “**Multimedia making it work**”, Tata McGraw-Hill, 2008.
3. Rajneesh Aggarwal & B. B Tiwari, “**Multimedia Systems**”, Excel Publication, New Delhi, 2007.
4. Dieter Schmalstieg and Tobias Höllerer, “**Augmented Reality: Principles & Practice**”, Pearson Education India, 2016.

E-References:

1. <https://www.studocu.com/en-gb/document/university-of-northampton/programming/multimedia-systems-lecture-notes/3332645>
2. <https://mu.ac.in/wp-content/uploads/2021/04/Multimedia.pdf>
3. <https://www.omegacollege.in/officialdocuments/NOTES/PGDCA-DCA/DCA-1-SEM/OMEGA-NOTES/ENGLISH-NOTES/EN-P1-FOM2.pdf>
4. https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/DC-AP303_MULTI MEDIA_SYSTEMS.pdf

DEPARTMENT OF MCA

SECOND SEMESTER

ELECTIVE 1-COMPUTER NETWORKS
(For Students admitted from 2023 onwards)

Course Code : 2329213(C)	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- To make the student understand the concepts and fundamentals of data communication and computer networks.
- To know about the OSI reference model.
- To impart the functioning of different layers in OSI.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand knowledge of the principles and concepts of computer networks and the design of OSI layers.
CO2	Explore the insights into the Data Link Layer protocols
CO3	Demonstrate the function of Medium Access sub layer
CO4	Identify the design issues and solutions in the Network Layer
CO5	Describe the concepts of TCP protocol

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction: Network Hardware – Network Software – Reference Models: OSI and TCP/IP models – Physical layer: Guided transmission media–Wireless Transmission–Communication Satellites.	12	CO1
2	Digital Modulation and Multiplexing - Switching: Circuit and Packet switching. Data link layer: Design issues – error detection and correction, Elementary data link protocols – Sliding window protocols.	12	CO2
3	Medium Access Sub Layer: Channel Allocation Problem – Multiple Access Protocols: ALOHA– Carrier Sense Multiple Access Protocols – Collision Free Protocols – Limited Contention Protocols.	12	CO3
4	Network layer: design issues – Routing Algorithms: Shortest Path Routing – Flooding – Distance Vector Routing – Link State Routing – Congestion control algorithms: Approaches to congestion control-traffic aware routing-admission control-traffic throttling - load shedding.	12	CO4
5	Transport layer: Transport service - services provided to the upper layers - transport service primitives - Elements: addressing - connection establishment - connection release – TCP: TCP service model – TCP protocol – TCP segment header – TCP connection establishment — TCP connection release – TCP connection management modelling – TCP sliding window.	12	CO5

Text Book:

1. A.S.Tanenbaum and David J. Wetherall, “**Computer Networks**”, Pearson Education, 5th Edition, ISBN : 978-93- 325-1874-2

Reference Books:

1. Berouze A Forouzan , “**Data Communications and Networking**”, Fourth Edition, Tata McGraw Hill,.
2. James F. Kurose and Keith W. Ross, ”**Computer Networking**”, Sixth Edition, Pearson.

E-References:

1. <https://www.javatpoint.com/computer-network-tutorial>
2. <https://www.geeksforgeeks.org/computer-network-tutorials/>
3. <https://www.guru99.com/data-communication-computer-network-tutorial.html>

DEPARTMENT OF MCA

SECOND SEMESTER

CORE PRACTICAL III-PYTHON PROGRAMMING LAB

(For Students admitted from 2023 onwards)

Course Code	: 2329214	Credits	: 02
L:T:P:S	: 0:0:4:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *Master the fundamentals of writing Python scripts*
- *Learn core Python scripting elements such as variables and flow control structures*
- *Discover how to work with lists and sequence data*
- *Write Python functions to facilitate code reuse*
- *Use Python to read and write files*
- *Make their code robust by handling errors and exceptions properly*
- *Work with the Python standard library*
- *Explore Python's object-oriented features*

Lab Exercises:

1. Data types in Python
2. Operators in Python
3. Conditional Statements
4. Iterative Statements
5. Functions
6. Modules
7. String Operations
8. List Operations
9. Tuple Operations
10. Dictionary Operations
11. Set Operations
12. Class and Objects
13. Inheritance
14. Exception Handling
15. File Operations
16. Python with MySQL
17. Working with Matplotlib for plotting charts and graphs
18. Working with NumPy
19. Working with Scipy
20. Working with Pandas

DEPARTMENT OF MCA

SECOND SEMESTER

CORE PRACTICAL IV-MOBILE APPLICATION DEVELOPMENT LAB

(For Students admitted from 2023 onwards)

Course Code : 2329215	Credits	: 02
L:T:P:S : 0:0:4:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *Describe the platforms upon which the Android OS will run.*
- *Create simple applications that runs under Android OS*
- *Access and work with the Android file system*
- *Define and access with databases under Android OS*

Lab Exercises:

1. Activity Lifecycle
2. Fragments
3. Notifications
4. Screen Orientation
5. Implicit and Explicit Intents
6. Intents returning results
7. Working with Basic Widgets-Button, Textview, Edittext, Togglebutton, Radiobutton, Radiogroup, Autocompletetextview, Checkbox, Seekbar, Listview, Pickerviews.
8. Storing data permanently using Shared preferences, Files and SQLite
9. Sending SMS
10. Location Based Services
11. JSON Services
12. Socket Programming
13. Illustration of menus-Option menu, Context menu, Popup menu
14. Android Services
15. Android Threading

DEPARTMENT OF MCA

SECOND SEMESTER

SOFT SKILLS-II QUANTATIVE APTITUDE
(For Students admitted from 2023 onwards)

Course Code	: 2350202	Credits	: 02
L:T:P:S	: 2:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Unit – I: Number System I & II – HCF, LCM, Decimal Fractions, Square roots and Cube Roots.

Unit – II: Ratio, Proportion and Variation, Averages, Problems on Ages, Percentages, Simple Interest and Compound Interest

Unit – III: Profit and Loss, Linear Equations, Areas and Volumes – Basics, Quadratic Equations.

Unit – IV: Time, Speed and Distance, Problems on Trains, Boats & Streams, Height and Distance

Unit – V: Probability, Permutation & Combination – basics, Calendar and Clocks.

Reference Books:

1. R.S. Aggarwal, “**Quantitative Aptitude for Competitive Examinations**”, S Chand Publisher, 20th edition (2013), ISBN-13: 978-8121924986
2. Arun Sharma, “**How to Prepare for Quantitative Aptitude for the CAT**”, Mcgraw Hill Education, 6 th Edition, ISBN-13: 9789339205126
3. Abhijit Guha, “**Quantitative Aptitude for Competitive Examinations**”, Mcgraw Hill Education, 5th Edition, ISBN-13: 9789351343554
4. R.V Praveen, “**Quantitative Aptitude and Reasoning**”, PHI, 2nd Edition (2013), ISBN- 978-81-203- 4777-9

E-References:

1. <http://www.indiabix.com>
2. <http://www.geeksforgeeks.com>
3. <http://www.examveda.com>
4. <http://www.javatpoint.com>
5. <http://www.apititudeschool.com>

*******End of Second Semester*******

DEPARTMENT OF MCA

THIRD SEMESTER

CORE-INTRODUCTION TO BIG DATA ANALYTICS

(For Students admitted from 2023 onwards)

Course Code : 2329317	Credits	: 04
L:T:P:S : 3:1:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *To explore the fundamental concepts of big data analytics*
- *To learn to analyze the big data using intelligent techniques.*
- *To understand the various search methods and visualization techniques.*
- *To learn to use various techniques for mining data stream.*
- *To understand the applications using MapReduce Concepts*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Knows the reason about the evolution of data science and its development. Study the basic of big data analytics and to develop the code. Importance of various kinds of data comparing the other language.
CO2	Develop HDFS environment using NOSQL implementing the queries. Aggregate the data using NOSQL.
CO3	Concept of basic Hadoop, data format and analyzing the data in the HDFS environment. Implementing the concept Hadoop pipes and implementations and java interfaces. Significance of various methods of compression, serialization.
CO4	Apply Mapreduce applications, unit test , MRUnit, Create file using MapReduce sorting and shuffling process. Creating input and output format of Mapreduce.
CO5	Usage of Hadoop related tools. Definition of hbase, Hbase clients, Cassandra, Pig, HiveQL. Life Build data manipulation by HiveQL queries. Analyze Life Build data manipulation by HiveQL queries.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Understanding big data: What is Big Data – Why Big Data – Convergence of key trends – unstructured data – industry examples of Big Data – Web analytics – Big Data and marketing – Fraud and Big Data – Risk and Big Data – Credit Risk Management – Big Data and algorithmic trading – Big Data and healthcare – Big Data in Medicine.	12	CO1
2	NoSQL data management: Introduction to NoSQL – Aggregate Data Models – Aggregates – Key- Value And Document Data Models – Relationships – Graph Databases – Schema less Databases – Materialized Views – Distribution Models – Sharding – Master-Slave Replication – Peer-Peer Replication - Sharding And Replication – Consistency – Relaxing Consistency – Version Stamps – MapReduce – Partitioning and Combining – Composing MapReduce Calculations.	12	CO2
3	Basics of Hadoop: Data format – Analyzing data with Hadoop – Scaling out – Hadoop streaming- Hadoop pipes – Design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface - data flow – Hadoop I/O – Data Integrity – Compression – Serialization – Avro – File-Based Data Structures.	12	CO3
4	MapReduce applications: MapReduce workflows – Unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map- reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – Input Formats – Output Formats.	12	CO4
5	Hadoop related tools: Hbase – Data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – Pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries.	12	CO5

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "**Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses**", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "**NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence**", Addison-Wesley Professional,2012.
3. Tom White, "**Hadoop: The Definitive Guide**", Third Edition, O'Reilley,2012.
4. Eric Sammer, "**Hadoop Operations**", O'Reilley, 2012.
5. AlanGates, "**Programming Pig**",O'Reilley,2011.
6. Alex Holmes, "**Hadoop in Practice**", MANNING Publications.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "**Programming Hive**", O'Reilley,2012.

Reference Books:

1. Lars George, "**HBase: The Definitive Guide**", O'Reilly,2011.
2. Eben Hewitt, "**Cassandra: The Definitive Guide**", O'Reilly,2010.

E-References:

1. Hadoop:<http://hadoop.apache.org/>
2. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home> Piglatin:
3. <http://pig.apache.org/docs/r0.7.0/tutorial.html>

DEPARTMENT OF MCA

THIRD SEMESTER

CORE-R PROGRAMMING

(For Students admitted from 2023 onwards)

Course Code : 2329318	Credits	: 04
L:T:P:S : 3:1:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *To understand the basics in R programming in terms of constructs, control statements, string functions*
- *To learn to apply R programming for Text processing*
- *To understand the use of R Big Data analytics*
- *To able to appreciate and apply the R programming from a statistical perspective*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Study and use basic fundamental concepts to solve the real-world problem using R programming language.
CO2	Design and implement the the functional programming and data manipulation statements, solution using scalar, vectors, matrices and arrays in R program.
CO3	Infer about lists, strings, dates, and data inputs and to solve statistical problems in R.
CO4	Identify data frames to provide the solution for various problem.
CO5	Explore visualization and statistical analysis using R. implement graphics with R.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Introduction to R Programming: History of R-Why R?-Advantages of R over other Programming Languages-Handling Packages in R-Working with Directory-Data types in R- Variables and assignment-Expressions- Complex numbers in R-Operators in R - Logical operations: TRUE and T with FALSE and F, Testing for equality with real numbers, Equality of floating point numbers using all.equal, Summarizing differences between objects using all.equal, Evaluation of combinations of TRUE and FALSE, Logical arithmetic-Membership Testing and coercing in R.	12	CO1
2	Control Structures, Vectors, Matrices and Arrays in R: Control Statements: if statement, if else statement, if else if ladder statement, Nested if-else statement, switch statement- Loops: while, repeat and for loop- Vectors and subscripts-Vector functions-Matrices and arrays.	12	CO2
3	Lists, Strings, Dates and Data Input in R: Lists-Text, character strings and pattern matching-Dates and times in R- Writing R functions-Data input from the keyboard- Data input from files-Input from files using scan-Reading data from a file using readLines.	12	CO3
4	Data Frames in R: Subscripts and indices-Selecting rows from the dataframe at random-Sorting dataframes-Using logical conditions to select rows from the dataframe-Omitting rows containing missing values, NA- Using order and duplicated to eliminate pseudoreplication-A dataframe with row names instead of row numbers- Creating a dataframe from another kind of object-Eliminating duplicate rows from a dataframe-Merging two dataframes.	12	CO4
5	Graphics in R: Plots with two variables-Plotting with two continuous explanatory variables: Scatterplots-Adding other shapes to a plot-Plotting with a categorical explanatory variable-Plots for single samples-Plots with multiple variables-Saving graphics to a file.	12	CO5

Text Books:

1. Michael J. Crawley, “**The R Book**”, Second Edition, John Wiley and Sons, 2013.
2. Seema Acharya, “**Data Analytics using R**”, Tata McGraw Hill, 2018.

Reference Books:

1. Norman Mat off, “**The Art of R Programming: A Tour of Statistical Software Design**”, No Starch Press, 2011.
2. Jared P. Lander, “**R for Everyone: Advanced Analytics and Graphics**”, Addison-Wesley.
3. Mark Gardener, “**Beginning R – The Statistical Programming Language**”, Wiley, 2013
4. Robert Knell, “**Introductory R: A Beginner’s Guide to Data Visualization, Statistical Analysis and Programming in R**”, Amazon Digital South Asia Services Inc, 2013.’

E-References:

1. <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470515075>
2. <https://rstudio-education.github.io/hopr/>
3. <https://r4ds.had.co.nz/> 4. <https://www.rstudio.com/>

DEPARTMENT OF MCA

THIRD SEMESTER

CORE- MACHINE LEARNING
(For Students admitted from 2023 onwards)

Course Code : 2329319	Credits	: 04
L:T:P:S : 3:1:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *To understand the concept of Machine Learning fundamentals.*
- *To understand the strengths and weaknesses of many popular machine learning approaches.*
- *Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.*
- *Be able to design and implement various machine learning algorithms in a range of real-world applications.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Interpret basic concepts and techniques of machine learning
CO2	Recognize the need of regression model
CO3	Elaborate Decision tree techniques
CO4	Learn the concepts in Bayesian analysis from probability models and methods
CO5	Describe various clustering techniques.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	2	3
CO3	3	2	3	3
CO4	2	3	3	3
CO5	3	3	2	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Introduction to Machine Learning: Definition of machine learning, Types of Machine Learning, Applications of Machine Learning. Data Pre-processing: Data Cleaning, Data Integration, Data Transformation, Dimensionality Reduction.	12	CO1
2	Linear Regression: Introduction to supervised learning and regression, Statistical Relation between Two variables and Scatter Plots, Steps to Establish a Linear Regression, Evaluation of Model Estimators. Logistic Regression: Introduction to Logistic Regression, Building Logistic Regression Model, Maximum Likelihood Estimation.	12	CO2
3	Decision Tree: Introduction to Classification and Decision tree, Basic Decision Tree learning Algorithms -Attribute Selection Measures, ID3, Steps to construct Decision tree, Issues in Decision trees, Rule-based Classification, Pruning the rule set.	12	CO3
4	Bayesian Classification: Introduction to Bayesian Classifiers -Bayes Theorem, Naïve Bayes classifier, Bayesian Belief Networks, k-Nearest Neighbor (KNN), Measuring classifier Accuracy.	12	CO4
5	Introduction to Unsupervised Learning Algorithms: Introduction to Clustering-Applications of clustering, Requirements of Clustering, Types of Clustering, Partitioning Methods of Clustering- k-Means algorithm, Hierarchical Method- Agglomerative Algorithm.	12	CO5

Text Book:

1. Anuradha Srinivasaraghavan, Vincy Joseph,” **Machine Learning**”, Wiley, 2019.

Reference Books:

1. Marco Gori , “**Machine Learning: A Constraint-Based Approach**”, Morgan Kaufmann. 2017
2. Ethem Alpaydin, “**Machine Learning: The New AI**”, MIT Press-2016
3. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “**Machine Learning**”, 2019.
4. Tom Mitchell, “**Machine Learning**”, 1st Edition, McGraw- Hill, 1997.

E-References:

1. <https://nptel.ac.in/courses/106/105/106105152/>
2. <http://www.cs.cmu.edu/~tom/mlbook.html>
3. <https://www.cs.cmu.edu/~hn1/tex/machine-learning/notes.pdf>
4. <https://www.javatpoint.com/machine-learning>

DEPARTMENT OF MCA

THIRD SEMESTER

ELECTIVE 2-SOFT COMPUTING

(For Students admitted from 2023 onwards)

Course Code	: 2329320 (A)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- To gain a basic understanding of neural network theory and fuzzy logic theory
- To identify different neural network architectures, algorithms, applications and their limitations
- To comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory
- To analyze appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- To develop the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic, Basic knowledge of Genetic algorithm and operators.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain basic knowledge of Artificial Neural Network, Fuzzy logic and Genetic algorithms
CO2	Analyze different neural network architectures
CO3	Get insight into classical sets and fuzzy sets and the concepts of fuzzy relations
CO4	Understand the basics of Genetic Algorithms
CO5	Gain knowledge of various operators of Genetic algorithms and the Schema Theorem

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	2	3	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction: Neural Networks – Application Scope of Neural Networks -Fuzzy Logic – Genetic Algorithms – Hybrid Systems. Artificial Neural Network – Fundamental Concept – Basic Models of Neural Network – Important Terminologies of ANN – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	12	CO1
2	Supervised Learning Network – Perceptron Networks – Adaptive Linear Neuron – Multiple Adaptive Linear Neuron – Back-Propagation network. Unsupervised Learning Networks- Kohonen Self-Organizing Maps.	12	CO2
3	Introduction to Fuzzy logic, Classical Sets and Fuzzy Sets: Introduction to Fuzzy Logic - Classical Sets - Fuzzy Sets. Classical Relations and Fuzzy Relations – Cartesian product of Relation – Classical Relation - Fuzzy Relations. Membership Functions.	12	CO3
4	Defuzzification – Lambda – Cuts for Fuzzy sets and Fuzzy Relation-Defuzzification methods. Genetic Algorithm – Biological Background – Basic Terminologies in Genetic Algorithm -Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm – Encoding.	12	CO4
5	Selection - Crossover – Mutation – Stopping condition for Genetic Algorithm flow –M Constraints in Genetic Algorithm – The Schema Theorem - Advantages and Limitations of GA - Applications of GA.	12	CO5

Text Book:

1. SN Sivanandan and SN Deepa (2019). “*Principles of Soft Computing*”, 3rd Edition, Wiley India.

Reference Books:

2. S Rajasekaran and GAV Pai (2003), “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI.
3. Timothy J Ross (1997), “Fuzzy Logic with Engineering Applications”, McGraw-Hill.
4. JSR Jang, CT Sun and E Mizutani (2004)., “Neuro-Fuzzy and Soft Computing”, Pearson Education, PHI.

E-References:

1. <http://www.nptel.iitm.ac.in/video.php?subjectId=117105084>
2. www.nptel.iitm.ac.in/syllabus/111106049
3. www.iitg.ac.in/rkbc/CE602/GA.pdf

DEPARTMENT OF MCA

THIRD SEMESTER

ELECTIVE 2-NETWORK SECURITY
(For Students admitted from 2023 onwards)

Course Code : 2329320 (B)	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- To know about various encryption techniques.
- To understand the concept of Public key cryptography.
- To study about message authentication and hash functions
- To impart knowledge on Network security

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Identify the importance of security and understand the basic encryption techniques
CO2	Illustrate Block ciphers, AES and DES
CO3	Evaluate the random number generation and public key cryptographic algorithms
CO4	Discuss authentication applications
CO5	Summarize the intrusion detection and its solutions to overcome the attacks.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	2	2	1
CO4	3	3	3	3
CO5	3	3	2	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Computer and Network Security Concepts: Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Model for Network Security. Classical encryption techniques: substitution techniques, transposition techniques, Rotor Machines, steganography.	12	CO1
2	Block ciphers and Data Encryption Standard: Block Cipher Structure, Data Encryption Standard (DES), Strength of DES, and Block Cipher Design Principles. Advanced Encryption Standard: AES Structure, AES Transformation Functions, AES Key Expansion and AES	12	CO2

	Implementation.		
3	Random Number Generation and Stream Cyphers: Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, Pseudorandom Number Generation using Block cipher and Stream Ciphers. Public key cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, Key distribution, Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	12	CO3
4	Message authentication: Authentication requirement, Authentication functions – MAC – Hash function – Security of hash function and MAC and SHA. Digital signatures, EDSS, SDSS, NIST Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.	12	CO4
5	Wireless Network Security: Wireless Security, Mobile Device Security. Electronic Mail security: Internet Mail Architecture, Email formats, Email Threats, S/MIME. IP security overview, IP Security Policy– System Security: Intruders – Malicious software –viruses – Firewalls.	12	CO5

Text Book:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson India Education Services, Seventh Edition, 2017.

Reference Books:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan, "Cryptography and Network Security", Wiley India Pvt. Ltd
2. Behrouz A. Foruzan, "Cryptography and Network Security", Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a PUBLIC World", Prentice Hall, ISBN0-13-046019-2

E-References:

1. https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
2. <https://www.pdfdrive.com/network-security-books.html>

DEPARTMENT OF MCA

THIRD SEMESTER

ELECTIVE 2-ETHICAL HACKING
(For Students admitted from 2023 onwards)

Course Code : 2329320 (C)	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 50
Exam Hours : 03	ESE Marks	: 50

Course Objectives:

- *To understand and analyze Information security threats and counter measures*
- *To perform security auditing & testing*
- *To understand issues relating to ethical hacking*
- *To study & employ network defense measures*
-

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Identify the vulnerabilities/threats/attacks.
CO2	Describe penetration & security testing. Use tools to identify vulnerable entry points
CO3	Identify vulnerabilities using sniffers at different layers. Interpret safe penetration techniques on the World Wide Web.
CO4	Design a computer against a variety of security attacks using various tools. Handle web application vulnerabilities
CO5	Identify attacks in wireless networks and how to become a professional ethical hacker.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	2	3	3	3
CO3	2	3	3	2
CO4	2	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	ETHICAL HACKING OVERVIEW & VULNERABILITIES: Understanding the importance of security-Concept of ethical hacking and essential Terminologies Threat- Attack- Vulnerabilities- Target of Evaluation- Exploit. Phases involved in hacking.	12	CO1
2	FOOTPRINTING & PORT SCANNING : Footprinting - Introduction to foot printing- Understanding the information gathering methodology of the hackers - Tools used for the reconnaissance phase. Port Scanning – Introduction - using port scanning tools - Ping sweeps - Scripting Enumeration - Introduction- Enumerating windows OS & Linux OS.	12	CO2

3	SYSTEM HACKING: Aspect of remote password guessing- Role of eavesdropping - Various methods of password cracking- Keystroke Loggers - Understanding Sniffers Comprehending Active and Passive Sniffing - ARP Spoofing and Redirection- DNS and IP Sniffing - HTTPS Sniffing.	12	CO3
4	HACKING WEB SERVICES & SESSION HIJACKING: Web application vulnerabilities - Application coding errors - SQL injection into Back-end Databases – Cross - site	12	CO4
	scripting – cross -Site request forging - Authentication bypass - Web services and related flaws - Protective http headers Understanding Session Hijacking - Phases involved in Session Hijacking - Types of Session Hijacking - Session Hijacking Tools.		
5	HACKING WIRELESS NETWORKS: Introduction to 802.11 - Role of WEP - Cracking WEP Keys - Sniffing Traffic Wireless DOS attacks – WLAN Scanners – LAN Sniffers – Hacking Tools - Securing Wireless Networks.	12	CO5

Text Books:

1. Kimberly Graves, "**Certified Ethical Hacker**", Wiley India Pvt Ltd, 2010.
2. Michael T. Simpson, "**Hands-on Ethical Hacking & Network Defense**", Course Technology, 2010.

Reference Books:

1. Patrick Engebretson, "**The Basics of Hacking and Penetration Testing- Ethical Hacking and Penetration Testing Made Easy**", Syngress Media, Second Revised Edition, 2013.
2. RajatKhare, "**Network Security and Ethical Hacking**", Luniver Press, 2006.
3. Ramachandran V, "**Wireless Penetration Testing Beginner's Guide** " 3rd ed.. Packt Publishing, 2011.
4. Thomas Mathew, "**Ethical Hacking**", OSB publishers, 2003.

E-References:

1. <https://www.elsevier.com/books/>
2. <https://www.elsevier.com/books/cyber-security-awareness-forlawyers>
3. <https://books.google.co.in/books>
4. <https://www.coursera.org/specializations/ethical-hacking>
5. <https://nptel.ac.in/courses>

DEPARTMENT OF MCA

THIRD SEMESTER

ELECTIVE 3-INTRODUCTION TO INTERNET OF THINGS

(For Students admitted from 2023 onwards)

Course Code	: 2329321(A)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *To understand the fundamentals of Internet of Things*
- *To learn about the basics of IOT protocols*
- *To build a small low cost embedded system using RaspberryPi.*
- *To apply the concept of Internet of Things in the real world scenario*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Interpret the vision of IoT from a global context
CO2	Describe the fundamentals of IoT and M2M
CO3	Analyze applications of IoT in Raspberry PI
CO4	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
CO5	Determine the market perspective of IoT and illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	2	3	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction - Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates.	12	CO1
2	Iot and M2M - M2M – Difference between IoT and M2M-SDN and NFV for IoT - IoT system management –Need for SNMP-Network operator requirements- NETCONF -YANG - IoT System Management with	12	CO2

	NETCONF-YANG.		
3	IoT Platforms Design Methodology: Ten steps in IoT design methodology- IoT Physical Devices & Endpoints: Basic building blocks of IoT devices – Exemplary device: Raspberry Pi – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming Raspberry Pi with Python.	12	CO3
4	IoT Physical Servers and Cloud Offerings: Introduction to Cloud storage models and Communication APIs – WAMPAutoBahn for IoT – Xively Cloud for IoT – Python Web Application Framework -DJANGO – Amazon Web Services for IoT – Amazon EC2 – Amazon AutoScaling – Amazon S3 – AmazonRDS – Amazon DynamoDB – Data Analytics for IoT: Apache Hadoop –MapReduce Programming Model – Hadoop MapReduce job Execution – MapReduce job for Execution Workflow.	12	CO4
5	Case Studies and Real-World Applications: Realworld design constraints– Applications:Asset Management - Smart Grid - Commercial Building Automation - Smart Cities - Participatory Sensing.	12	CO5

Text Books:

1. Arshdeep Bahga, Vijay Madiseti, “**Internet of Things: A Hands-on Approach**”, First Edition, Universities Press, 2015.
2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "**From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence**", Elsevier, 2014.

Reference Books:

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “**Architecting the Internet of Things**”, Springer, 2011.
2. Honbo Zhou, “**The Internet of Things in the Cloud: A Middleware Perspective**”, CRC Press, 2012.
3. Olivier Hersent, David Boswarthick, Omar Elloumi ,”**The Internet of Things – Key applications and Protocols**”, Wiley, 2012
4. Ammar Rayes, Samere Salam,“**Internet of Things – From Hype to Reality**”, First Edition, Springer Publishers, 2017.
5. Raj Kamal, “**Internet of Things Architecture and Design Principles**”, First Edition, Mc-Graw Hill Education, 2017.
6. Agus Kurniawan, “**Smart Internet of Things Projects**”, First Edition, Packt Publishing Ltd., 2016.

E-References:

1. <https://nptel.ac.in/courses/106/105/106105166/>
2. <https://www.edureka.co/blog/iot-tutorial/>
3. <https://www.javatpoint.com/iot-internet-of-things>

DEPARTMENT OF MCA

THIRD SEMESTER

ELECTIVE 3-BLOCK CHAIN TECHNOLOGY

(For Students admitted from 2023 onwards)

Course Code	: 2329321(B)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
- To securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from blockchain technology into their own projects.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the abstract models behind Blockchain Technology.
CO2	Identify the insights of crypto currency domain-Bitcoin.
CO3	Demonstrate the Ethereum platform as an example for Blockchain technology.
CO4	Apply hyperledger Fabric to implement the Block chain Application.
CO5	Discuss the various application areas of Blockchain

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO 1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	2	3

3-Strong 2-Medium 1-Low

Sl No.	Contents of Module	Hrs	COs
1	Introduction to Blockchain: Blockchain-Centralized vs Decentralized systems-Layers of blockchain- Limitations of Centralized Systems - Blockchain adoption so far- Blockchain uses and Use cases-Byzantine Generals' Problem-The blockchain and Merkle Trees-Properties of Blockchain Solutions-Blockchain Transactions-Distributed Consensus Mechanisms-Blockchain applications.	12	CO1

2	Working of BitCoin: Bitcoin -Working with bitcoins- The Bitcoin Blockchain: Block Structure, The Genesis Block- The Bitcoin Network: Bitcoin Transactions, Consensus and Block Mining, Block Propagation-Full Nodes vs SPVs.	12	CO2
3	Working of Ethereum: Design Philosophy of Ethereum-Etherium Blockchain- Ethereum accounts-Trie Usage-Merkle Patricia Tree - Ethereum Transaction and Message Structure-Ethereum State Transaction Function-Gas and Transaction Cost- Ethereum smart contracts-Ethereum virtual machine and code execution- Ethereum Ecosystem: Swarm, Whisper, DApp, Development Components.	12	CO3
4	Hyperledger: Introduction to Hyperledger-Blockchain for business-Advantages of Hyperledger fabric-Problems with existing blockchain technology-Hyperledger fabric architecture-Consensus in Hyperledger-Hyperledger tools-Hyperledger components.	12	CO4
5	Blockchain-Outside of Currencies: Internet of Things: Physical Object Layer, Device Layer, Network Layer, Management Layer and Application Layer- Government: Border control, Voting, ID cards- Health-Finance: Insurance, Post trade settlement and Financial Crime Prevention, Media.	12	CO5

Text Books:

1. B. Singhal & G. Dhameja, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", First Edition, Apress 2018. (Units:I,II,III)
2. Nakul Shah, "Blockchain for Business with Hyperledger Fabric: A complete guide to enterprise blockchain implementation using Hyperledger Fabric", BPB Publications, 2019 (Unit IV)
3. Bashir, Imran, "Mastering Blockchain: Deeper Insights Into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks", 2017. (Unit V)

Reference Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. D. Mohanty, "Blockchain - From Concept to Execution", (2e) BPB Publications, 2018.
3. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies".
4. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System".

E-References:

1. <https://www.tutorialspoint.com/blockchain/index.htm>
2. <https://www.javatpoint.com/blockchain-tutorial>
3. <https://nptel.ac.in/courses/106/105/106105184/>
4. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

DEPARTMENT OF MCA
THIRD SEMESTER

ELECTIVE 3-GREEN

COMPUTING

(For Students admitted from 2023 onwards)

Course Code	: 2329321(C)	Credits	: 04
L:T:P:S	: 4:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *To learn the fundamentals of Green Computing.*
- *To analyze the Green computing Grid Framework.*
- *To understand the issues related with Green compliance.*
- *To study and develop various case studies.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Discuss Green IT with its different dimensions and Strategies
CO2	Describe Green devices and hardware along with its green software methodologies.
CO3	Analyze the various green enterprise activities, functions and their role with IT.
CO4	Describe the concepts of how to manage the green IT with necessary components.
CO5	Discuss the various laws, standards and protocols, key sustainability for regulating green IT.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3
CO2	3	3	3	2
CO3	3	3	3	2
CO4	2	3	3	3
CO5	2	3	3	3

3-Strong 2-Medium 1-Low

Sl No	Contents of Module	Hrs	COs
1	Green IT-Overview: Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-	12	CO1

	Labelling of IT, Enterprise Green IT strategy, Green IT: Burden or Opportunity?		
2	Green Devices and Hardware with Green Software: Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and Measuring software Impact to platform power.	12	CO2
3	Green Enterprises and the Role of IT: Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.	12	CO3
4	Managing Green IT: Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media.	12	CO4
5	Regulating the Green IT: Laws, Standards and Protocols: Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements and Greenpeace. Green IT: An Outlook: Introduction, Awareness to implementations, Greening by IT, Green IT: A megatrend?, A seven-step approach to creating green IT strategy, Research and Development directions.	12	CO5

Text Book:

1. San Murugesan, G.R. Gangadharan, "Harnessing Green IT Principles and Practices", Wiley Publication, ISBN:9788126539680

Reference Books:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.
3. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011.
4. John Lamb, "The Greening of IT", Pearson Education, 2009..
5. Jason Harris, "Green Computing and Green IT- Best Practices on regulations and industry", Lulu.com, 2008
6. Carl Speshocky, "Empowering Green Initiatives with IT", John Wiley and Sons, 2010.
7. Wu Chun Feng, "Green computing: Large Scale energy efficiency", CRC Press

E-References:

1. <http://digitalthinkerhelp.com/what-is-green-computing-advantages-disadvantages-examples/>
2. https://www.tutorialspoint.com/environmental_studies/environmental_studies_towards_sustainable_future.htm

DEPARTMENT OF MCA

THIRD SEMESTER

CORE PRACTICAL V- BIG DATA ANALYTICS LAB

(For Students admitted from 2023 onwards)

Course Code	: 2329322	Credits	: 02
L:T:P:S	: 0:0:4:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *Demonstrate the insight of an exciting growing field of Big Data analytics.*
- *Derive the scripts of Hadoop, NoSql, MapReduce to develop the knowledge of data science*
- *Derive the coding to manage and analyze big data like Hadoop, NoSql, MapReduce.*
- *Practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies.*
- *Scaling up machine learning techniques focusing on industry applications.*
- *Exhibit the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.*
- *Validate the students to have skills that will help them to solve complex real-world problems in for decision support.*

Lab Exercises:

1. Perform setting up and Installing Hadoop in its three operating modes:
 - i. Standalone, Pseudo distributed, fully distributed
 - ii. Use web based tools to monitor your Hadoop setup.
2. Implement the following file management tasks in Hadoop:
 - a. Adding files and directories
 - b. Retrieving files
 - c. Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
4. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record- oriented.
5. Implement Matrix Multiplication with Hadoop MapReduce
6. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
7. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

DEPARTMENT OF MCA

THIRD SEMESTER

CORE PRACTICAL VI- R PROGRAMMING LAB

(For Students admitted from 2023 onwards)

Course Code	: 2329323	Credits	: 02
L:T:P:S	: 0:0:4:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

- *Demonstrate use of basic functions*
- *Create their own customized functions*
- *Construct tables and figures for descriptive statistics*
- *Learn to understand new data sets and functions*
- *Work on built-in real-time cases for analysis and visualization*

Lab Exercises:

1. Operators in R
2. Decision making statements in R
3. Loops in R
4. Vectors in R
5. Create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction
6. Arrays in R
7. Perform searching within a list (1 to 50). If the number is found in the list, print that the search is successful otherwise print that the number is not in the list.
8. Create a list containing strings, numbers, vectors and logical values and do the following manipulations over the list. a. Access the first element in the list b. Give the names to the elements in the list c. Add element at some position in the list d. Remove the element e. Print the fourth element f. Update the third element
9. Write an R program to create a Data Frame with following details and do the following operations.'

itemCode	itemCategory	ItemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

- a. Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
- b. Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies"
- c. Create another Data Frame

called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.

10. Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.
 - a. Find the total number rows & columns
 - b. Find the maximum salary
 - c. Retrieve the details of the employee with maximum salary
 - d. Retrieve all the employees working in the IT Department
 - e. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”.
11. Visualize the outcomes as graphs in R.

DEPARTMENT OF MCA

THIRD SEMESTER

SOFT SKILLS-III ANALYTICAL REASONING
(For Students admitted from 2023 onwards)

Course Code	:		Credits	: 02
L:T:P:S	: 2:0:0:0		CIA Marks	: 50
Exam Hours	: 03		ESE Marks	: 50

Unit – I: Series – AP, GP, HP, Set Theory, Areas and Volumes, Geometry, Trigonometry.

Unit – II: Data interpretation – Data tables, pie charts, bar charts, line graphs, Analogy, Classification, Series completion - Number Series, Letter Series, Coding & Decoding.

Unit – III: Blood relations, Symbol based statement conclusion, Cubes and Dices, figure formation, mirror images, water images, paper cutting.

Unit – IV: Analytical Reasoning, Syllogism, Seating arrangements and cases, Number, Ranking and Sequence test

Unit – V: Deductive logic, Rule detection, Statement and assumptions, Statement and arguments, Statement and conclusions.

Reference Books:

1. R.S. Aggarwal, “**Quantitative Aptitude for Competitive Examinations**”, S Chand Publisher, 20th edition (2013), ISBN-13: 978-8121924986
2. Arun Sharma, “**How to Prepare for Quantitative Aptitude for the CAT**”, Mcgraw Hill Education, 6 th Edition, ISBN-13: 9789339205126
3. Abhijit Guha, “**Quantitative Aptitude for Competitive Examinations**”, Mcgraw Hill Education, 5th Edition, ISBN-13: 9789351343554
4. R.V Praveen, “**Quantitative Aptitude and Reasoning**”, PHI, 2nd Edition (2013), ISBN- 978-81-203- 4777-9

E-References:

1. <http://www.indiabix.com>
2. <http://www.geeksforgeeks.com>
3. <http://www.examveda.com>
4. <http://www.javatpoint.com>
5. <http://www.apptitudeschool.com>

*******End of Third Semester*******

DEPARTMENT OF MCA

**FOURTH
SEMESTER**

CORE-

PROJECT

WORK

(For Students admitted from 2023 onwards)

Course Code	: 2329426	Credits	: 12
L:T:P:S	: 0:0:0:0	CIA Marks	: 50
Exam Hours	: 03	ESE Marks	: 50

Course Objectives:

Students will be able to:

- *Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.*
- *Develop software applications*
- *Record the research results for a given problem*
- *Identify, formulate and implement computing solutions.*
- *Design and conduct experiments, analyze and interpret data.*
- *Analyze a system, component or process as per needs and specification.*
- *Work on multidisciplinary tasks and will be aware of the new and emerging disciplines.*
- *Demonstrate skills to use modern tools, software and equipments to analyze problems.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate a sound technical knowledge, skills and attitude of their selected project topic.
CO2	Understand problem identification, formulation and solution.
CO3	Design solutions to complex problems utilizing a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO 1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	2
CO3	3	3	3	2
CO4	2	3	3	3

3-Strong 2-Medium 1-Low

Procedure:

- The Head of the Department will assign an Internal Guide for each student.
- As soon as the student gets project, the student should submit the abstract of the project and the contact details of the organization to their guide.
- During regular intervals, student should report about their progress of the project work.
- The final semester will be entirely assigned for the student to carry out their project work.
- After the submission of the final report, an external examiner will evaluate the project document and conduct the viva voce examination.

DEPARTMENT OF MCA

FOURTH SEMESTER

SOFT SKILLS-IV PERSONALITY DEVELOPMENT
(For Students admitted from 2023 onwards)

Course Code	:		Credits	: 02
L:T:P:S	:	0:0:0:0	CIA Marks	: 50
Exam Hours	:	03	ESE Marks	: 50

UNIT-I: Introduction to Personality Development

The concept of personality - Dimensions of personality – Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

UNIT-II: Attitude & Motivation

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages – Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation

UNIT-III: Self-esteem

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self esteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT-IV: Other Aspects of Personality Development

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.

UNIT-V: Employability Quotient

Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview - Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

Text Books:

1. Hurlock, E.B (2006),”**Personality Development**”, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge(2014), “**Organizational Behavior**”, 16th Edition: Prentice Hall. Reference Books:
3. Andrews, Sudhir, ”**How to Succeed at Interviews**”,21st (rep.) New Delhi.Tata McGraw-Hill

1988.

4. Heller, Robert, "**Effective leadership. Essential Manager series**", Dk Publishing, 2002
5. Hindle, Tim, "**Reducing Stress. Essential Manager series**", Dk Publishing, 2003
6. Lucas, Stephen, "**Art of Public Speaking**", New Delhi. Tata - Mc-Graw Hill. 2001
7. Mile.D.J, "**Power of positive thinking**", Delhi. Rohan Book Company, (2004).
8. Pravesh Kumar, "**All about Self- Motivation**", New Delhi. Goodwill Publishing House. 2005.

*******End of Fourth Semester*******