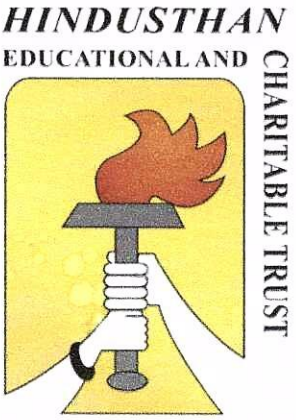

HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF COMPUTER APPLICATIONS

Curriculum and Syllabus for the Batch 2021-2023

2020 REGULATIONS

VISION AND MISSION OF THE INSTITUTION

VISION
To become a premier institution by producing professionals with strong technical Knowledge, innovative research skills and high ethical values

MISSION
IM1: To provide academic excellence in technical education through novel teaching Methods. IM2: To empower students with creative skills and leadership qualities. IM3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION
To be a department of excellence imparting computer application oriented education that creates professionals for contributing towards Innovation and social development.

MISSION
To achieve the vision of the department with sustained efforts to, DM1: To achieve academic excellence in computer applications related education through Novel teaching methods to equip students with required skills. DM2: To empower students in the department of computer applications with creative skills and leadership qualities, cultivating a learning environment that nurtures innovation and prepares future professionals. DM3: To produce dedicated professionals with a strong sense of social responsibility, emphasizing ethical practices in technology and to make meaningful contributions to society.

PROGRAM OUTCOMES (POs)

SL. NO	GRADUATE ATTRIBUTES	PROGRAM OUTCOME
1.	**Computational Knowledge**	Apply knowledge of computer fundamentals, computing specialization, mathematics and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements..
2.	**Problem Analysis**	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences and relevant domain disciplines.
3.	**Design / Development of Solutions**	Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal an environmental considerations.
4.	**Conduct Investigations of Complex Computing problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	**Modern Tool Usage**	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities with an understanding of the limitations.
6	**Professional Ethics**	Understand and commit to professional ethics and cyber regulations, responsibilities and norms of professional computing practice.
7.	**Life-Long Learning**	Recognize the need and have the ability to engage in independent learning for continual development as a computing professional.
8.	**Project Management and Finance**	Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.
9.	**Communication Efficacy**	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations and give and understand clear instructions.
10.	**Societal and Environmental Concern**	Understand and assess societal, environmental, health, safety, legal and cultural issues within local and global contexts and the consequential responsibilities relevant to professional computing practice.
11.	**Individual and Team Work**	Function effectively as an individual and as a member or leader in diverse teams and n multidisciplinary environments.
12.	**Innovation and Entrepreneurship**	Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. Take up career related to computer applications with required core competencies gained in an assessment driven learning environment.

PEO 2. Prepare graduates for execution of projects that require professionalism in digital industry to code, develop and test software, to perform research for providing software solutions.

PEO 3. Engage in entrepreneurship with given breadth of exposure, experience.

CBCS PATTERN

POSTGRADUATE PROGRAMMES

MCA. COMPUTER APPLICATIONS(PG)

REGULATION-2020

(For the students admitted during the academic year 2021-2022 and onwards)

SEMESTER I – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21CA1291	PoP& OOPS	BRIDGE	3	0	0	-	100	0	100
2.	21CA1292	Fundamentals Of Web Designing	BRIDGE	3	0	0	-	100	0	100
PRACTICAL										
3.	21CA1091	PoP& OOPS LAB	BRIDGE	0	0	3	-	100	0	100
			Total	**6**	**0**	**3**	**0**	**300**	**0**	**300**

SEMESTER I – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21MA1101	Probability And Statistics, Operations Research	FC	3	1	0	4	40	60	100
2.	21CA1201	UI Design & Development	PC	3	1	0	4	40	60	100
3.	21CA1202	Computer Networks	PC	3	0	0	3	40	60	100
4.	21CA1203	Java Programming	IC	3	1	0	4	40	60	100
5.	21CA1204	Database Management Systems	IC	3	0	0	3	40	60	100
PRACTICAL										
6.	21CA1001	Java Programming Lab	EEC	0	0	3	1.5	50	50	100
7.	21CA1002	DBMS Lab	EEC	0	0	3	1.5	50	50	100
8.	21CA1171	Communicative Skill for Business English	EEC	0	0	2	2	100	---	100
			Total	**15**	**3**	**8**	**23**	**400**	**400**	**800**

SEMESTER II – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21CA2291	Software Engineering	BRIDGE	3	0	0	-	100	0	100
2.	21CA2292	Operating System	BRIDGE	3	0	0	-	100	0	100
PRACTICAL										
3.	21CA2091	Software Engineering Tools Lab	BRIDGE	0	0	3	-	100	0	100
			Total	**6**	**0**	**3**	**0**	**300**	**0**	**300**

SEMESTER II – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21CA2201	Data Structures and Algorithms	PC	3	1	0	4	40	60	100
2.	21CA2202	Artificial Intelligence	PC	3	1	0	4	40	60	100
3.	21CA2203	Python Programming	PC	3	1	0	4	40	60	100
4.	21EC2231	Embedded System and Sensors	IC	3	0	0	3	40	60	100
5.	21CA23XX	Professional Elective -I/ NPTEL / EDX	PE	3	0	0	3	40	60	100
6.	21CA2171	L/S/MOOC	EEC	2	0	0	2	100	---	100
PRACTICAL										
7.	21CA2001	Python Programming Lab	EEC	0	0	3	1.5	50	50	100
8.	21CA2002	Data Structures & Algorithms Lab	EEC	0	0	3	1.5	50	50	100
9.	21CA2801	Internship / Industrial Training	EEC	0	0	0	2	100	---	100
			Total	**17**	**3**	**6**	**25**	**500**	**400**	**900**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1.	21CA3203R	Web Development	PC	3	1	0	4	40	60	100
2.	21CA3205	Cryptography and Network Security	IC	3	1	0	4	40	60	100
3.	21CA3251	Data Science and Analytics	PC	3	0	2	4	50	50	100
4.	21EC3251	Internet of Things	PC	2	0	2	3	50	50	100
5.	21CA33XX	Professional Elective -I/ NPTEL / EDX	PE	3	0	0	3	40	60	100
6.	21CA3571	L/S/MOOC	EEC	2	0	0	2	100	---	100
PRACTICAL										
7.	21CA3001	Mini Project Lab	EEC	0	0	3	1.5	60	40	100
8.	21CA3002R	Web Development Lab	EEC	0	0	3	1.5	60	40	100
			Total	**16**	**2**	**10**	**23**	**440**	**360**	**800**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1	21CA4901	Project Work	EEC	0	0	0	14	50	50	100
			Total	**0**	**0**	**0**	**14**	**50**	**50**	**100**

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21CA2301	Cyber Security	PE	3	0	0	3	40	60	100
2	21CA2302	Green Computing	PE	3	0	0	3	40	60	100
3	21CA2303	Human Computer Interaction	PE	3	0	0	3	40	60	100
4	21CA2304	Professional Ethics	PE	3	0	0	3	40	60	100
5	21CA2305	Web Graphics	PE	3	0	0	3	40	60	100
6	21CA2306	Digital Logic and Computer Organization	PE	3	0	0	3	40	60	100
7	21CA2307	E-Learning Techniques	PE	3	0	0	3	40	60	100
8	21CA2308	Block Chain Technologies	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II										
1	21CA3301	Accounting and Financial Management	PE	3	0	0	3	40	60	100
2	21CA3302	Cloud Computing and Security	PE	3	0	0	3	40	60	100
3	21CA3303	Soft Computing Techniques	PE	3	0	0	3	40	60	100
4	21CA3304	Deep Learning	PE	3	0	0	3	40	60	100
5	21CA3305	E- Commerce	PE	3	0	0	3	40	60	100
6	21CA3306	Mixed Reality	PE	3	0	0	3	40	60	100
7	21CA3307	Organizational Behaviour	PE	3	0	0	3	40	60	100
8	21CA3308	Research Methodology	PE	3	0	0	3	40	60	100
9	21CA3309	Semantic Web Services	PE	3	0	0	3	40	60	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	Total
Credits	23	25	23	14	**85**

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Dean (Academics)
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Principal

Dr. J. JAYA, M.Tech., Ph.D
PRINCIPAL
Hindusthan College of Engineering and Technology
COIMBATORE - 641 032.

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG.

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	20CA3201	Big Data Analytics	PC	3	1	0	4	40	60	100
2.	20CA3202	Operating Systems	PC	3	1	0	4	40	60	100
3.	20CA3203	Web Development	PC	3	1	0	4	40	60	100
4.	20CA3204	Artificial Intelligence	IC	3	0	0	3	40	60	100
5.	20CA33XX	Professional Elective -I/ NPTEL / EDX	PE	3	0	0	3	40	60	100
6.	20CA3571	L/S/MOOC	EEC	2	0	0	2	100	0	100
PRACTICAL										
7.	20CA3001	Mini Project Lab	EEC	0	0	3	1.5	50	50	100
8.	20CA3002	Web Development Lab	EEC	0	0	3	1.5	50	50	100
		Total		**17**	**3**	**6**	**23**	**400**	**400**	**800**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20CA4901	Project Work	EEC	0	0	0	14	50	50	100
		Total		**0**	**0**	**0**	**14**	**50**	**50**	**100**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE II										
1	20CA3301	Block Chain	PE	3	0	0	3	40	60	100
2	20CA3302	Cloud Computing	PE	3	0	0	3	40	60	100
3	20CA3303	Cryptography and Network Security	PE	3	0	0	3	40	60	100
4	20CA3304	Deep Learning	PE	3	0	0	3	40	60	100
5	20CA3305	E- Commerce	PE	3	0	0	3	40	60	100
6	20CA3306	Mixed Reality	PE	3	0	0	3	40	60	100
7	20CA3307	Organizational Behaviour	PE	3	0	0	3	40	60	100
8	20CA3308	Research Methodology	PE	3	0	0	3	40	60	100
9	20CA3309	Semantic Web Services	PE	3	0	0	3	40	60	100

CREDIT DISTRIBUTION

R2020

Semester	I	II	III	IV	Total
Credits	23	25	23	14	**85**

Chairman, Board of Studies **Dean – Academics** **Principal**

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PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

BRIDGE COURSE

Prograamme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1291	PoP& OOPS	3	0	0	-

COURSE OBJECTIVE

1. To Understand the basics concepts in C programming
2. To learn and apply arrays and pointers in C.
3. To gain knowledge in fundamentals of Object-Oriented Programming.
4. To gain proficiency in usage of classes and objects.
5. To explore advanced features of object-oriented programming

Pre – requisite - Nil

Unit	Description	Instructional Hours
I	**INTRODUCTION** Process of programming – Variables- Operators – Loops- Break statement – Continue Statement- Data Types in C – ASCII Code - Operators Expressions Associatively - Precedence of operators - Expression evaluation – Functions	9
II	**ARRAYS AND POINTERS** Arrays in C -Pointers in C -Programming using arrays and pointers -Sizeof operator - Returning pointers from functions – Recursion -Multidimensional Arrays and Pointers- Structures in C -Singly Linked Lists - Doubly Linked Lists- File Handling	9
III	**EVOLUTION OF OOP LANGUAGES** Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings- Function Overloading -Operator Overloading - Dynamic Memory Management	9
IV	**CLASSES AND OBJECTS** Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator- Constants - Static Members - friend Function and friend Class.	9
V	**ADVANCED FEATURES** Overloading Operator for User Defined Types-Namespace -Inheritance -Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions –Template - Closing Comments	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Illustrate and explain the basic computer concepts and programming principles of C language.
CO2: Demonstrate the applications of derived data types such as arrays, pointers, strings and functions.
CO3: Build programs in C++ using Overloading,
CO4: Develop skills in handling exceptions, working with classes and objects,
CO5: Construct C++ programs using advanced features of Oops

REFERENCE BOOKS:

1. The C++ Programming Language (4th Edition) By Bjarne Stroustrup,2013
2. C Programming Language (2nd Edition) By Brian W. Kernighan & Dennis M. Ritchie, 2015

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1292	FUNDAMENTALS OF WEB DESIGNING	3	0	0	-

COURSE OBJECTIVE

1. To introduce the fundamentals of Internet, and the principles of web design.
2. To construct basic websites using HTML.
3. To Design basic websites using and Cascading Style Sheets.
4. Knowledge in advanced features of Cascading Style Sheets.
5. To build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

Pre – requisite - Nil

Unit	Description	Instructional Hours
I	**INTRODUCTION TO WWW** Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.	9
II	**UI DESIGN** Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts - Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists	9
III	**CASCADING STYLE SHEET (CSS)** The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets	9
IV	**CASCADING STYLE SHEET (CSS)** Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.	9
V	**SCRIPTING LANGUAGES** HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Gain Profiency in concepts of World Wide Web, and the requirements of effective web design
CO2: Develop web pages using the HTML
CO3: Construct web page using CSS features with different layouts as per need of applications.
CO4: Develop web pages using advanced features of CSS.
CO5: Use the JavaScript to develop the dynamic web pages.

REFERENCE BOOKS :

R1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
R2. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition Tata McGraw-Hill 2010.
R3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
R4. Margaret Levine Young, "Internet and WWW", 2nd Edition, Tata McGraw Hill, 2002.
R5. Jeff Rule, Dynamic HTML: The HTML Developer's Guide, Addison-Wesley, 1999.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1091	PoP& OOPS LAB	0	0	3	-

COURSE OBJECTIVE

1. Able to understand the fundamental properties of C Language.
2. Knowledge of implementing data structures in C programming.
3. Understanding sorting and searching algorithms
4. Understand the syntax of C++ and writing simpleto advanced programs.
5. To understand the need and role of object oriented programming for real-world applications.

Pre – requisite - Nil

Unit	Description	Instructional Hours
1	Write a C program to check whether a number is even or odd	6
2	Write a C Program to Check Leap Year	6
3	Write a C Program to Find Factorial of a Number	3
4	Write a program to search a given element in array using linear search.	6
5	To find the smallest and largest element from a given array.	3
6	To Sort n numbers using bubble sort using function sub program.	3
7	Write a C++ program to perform String Concatenation • using Arrays • Using Functions • Using Arrays & functions Using Pointers & Functions	3
8	Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading.	6
9	Write a program to Illustrate Friend Function and Friend Class.	3
10	Write C++ Programs and incorporating various forms of Inheritance.	3
11	Write a C++ Program to illustrate Virtual functions	3
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Apply C Programming features to program design a nd implementation.
CO2: Able to identify the appropriate data structures and algorithms for solving real world problems.
CO3: implement various kinds of searching and sorting techniques.
CO4: Develop programs in C++ using advanced concepts in OOPS.
CO5: Develop the skills in programming using C++ which forms the basics for advanced Programming.

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SEMESTER I – REGULAR COURSES

Programme	Course Code	Name of the Course	L	T	P	C
MCA	21MA1101	PROBABILITY AND STATISTICS, OPERATIONS RESEARCH	3	1	0	4

COURSE OBJECTIVE

1. Understand the concepts of Probability fundamentals and random variables.
2. Apply testing of hypothesis to infer outcome of experiments.
3. Formulate and solve Linear Programming Problems.
4. Develop Problem-Solving Skills for Transportation and Assignment Models Construct Project Scheduling Techniques using Pert and CPM.

Pre – requisite - Nil

Unit	Description	Instructional Hours
I	**PROBABILITY AND RANDOM VARIABLE** Definition – Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem (without proof) -Random variable –Discrete and continuous random variables – Moment generating functions.	12
II	**TESTING OF HYPOTHESES** Sampling distributions -Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions -Tests for Independence of attributes and Goodness of fit.	12
III	**LINEAR PROGRAMMING MODELS** Mathematical Formulation of LPP- Graphical method– Simplex method – Artificial variable Techniques- Sensitivity analysis.	12
IV	**TRANSPORTATION AND ASSIGNMENT MODELS** Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.	12
V	**SCHEDULING BY PERT AND CPM** Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Apply probability concepts and analyze random variables in practical scenarios.
CO2: Proficiently conduct hypothesis tests using various distributions
CO3: Formulate linear programming problems from real-world situations, solve those using graphical and simplex methods, and conduct sensitivity analysis on the solutions.
CO4: Apply mathematical modeling to transportation problems, solve those using appropriate methods, handle degeneracy, and utilize the Hungarian Algorithm for assignment models.
CO5: Construct project networks, apply Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) for scheduling, and optimize resource allocation in network scheduling.

TEXT BOOKS:

1. Veerarajan, T., Probability, Statistics and Random Processes, Tata McGraw-Hill, 2nd Edition, New Delhi, 2010.
2. Taha H.A., "Operations Research: An Introduction "8th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

R1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.
R2. Man Mohan, Kanti Swarup, P. K. Gupta, "Introduction to Management Science Operations Research" Sultan Chand & Sons, 2014.
R3. A.M. Natarajan, Balasubramanian, A. Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.

S. No	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	Apply probability concepts and analyze random variables in practical scenarios.	3	3	-	2	-	-	-	-	-	-	-	-
CO2	Proficiently conduct hypothesis tests using various distributions	3	3	2	3	3	-	-	-	-	-	-	-
CO3	Formulate linear programming problems from real-world situations, solve those using graphical and simplex methods, and conduct sensitivity analysis on the solutions	3	3	2	2	3	-	-	-	-	2	-	-
CO4	Apply mathematical modeling to transportation problems, solve those using appropriate methods, handle degeneracy, and utilize the Hungarian Algorithm for assignment models.	3	3	2	2	3	-	-	-	-	2	-	-
CO5	Construct project networks, apply Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) for scheduling, and optimize resource allocation in network scheduling.	3	3	2	2	3	-	-	-	-	2	-	-
	CO PO Mapping Average Value	**3.0**	**3.0**	**2.0**	**2.2**	**3.0**	-	-	-	-	**2.0**	-	-

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1201	UI DESIGN AND DEVELOPMENT	3	1	3	4

COURSE OBJECTIVE

1. To evaluate the foundational components and protocols of the World Wide Web and demonstrate a comprehension of its architecture and associated Internet standards.
2. To implement HTML5 and CSS3 principles, utilize HTML5 APIs, SVG, Canvas, Audio & Video, Drag/Drop and master debugging and validation for enhanced user interfaces.
3. To Articulate the foundational aspects of JavaScript, including core features, data types, functions, and DOM manipulation, enabling effective utilization in web development.
4. To Attain proficiency in utilizing advanced JavaScript features, covering browser and media management, object-oriented techniques, JSON structure, jQuery, AJAX, and Bootstrap components.
5. To Acquire foundational skills in PHP and establishing connectivity with MySQL databases, within the context of web development.

Pre-Requisite – 21CA1292 Fundamentals of Web Design

Unit	Description	Instructional Hours
I	**INTRODUCTION TO WWW** Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP Request – Response — Generation of Dynamic Web Pages **Markup Language (HTML5):** Steps in design process -Basics of Html -Syntax and Tags of Html- Introduction to HTML5 - Semantic/Structural Elements	12
II	**UI DESIGN** HTML5 Style Guide and Coding Convention– Html Svg and Canvas – Html API"s - Audio & Video - Drag/Drop - Local Storage - Web Socket API– Debugging and Validating Html. **Cascading Style Sheet (CSS3):** The Need for CSS – Basic Syntax and Structure Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning Using CSS - Responsive Web Design -Introduction to LESS/SASS	12
III	**OVERVIEW OF JAVASCRIPT** Introduction - Core Features - Data Types and Variables - Operators, Expressions, and Statements Functions - Objects - Array, Date and Math Related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form Validations	12
IV	**ADVANCED FEATURES OF JAVASCRIPT** Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub Classes and Super Classes – Introduction to JSON– JSON Structure –Introduction to jQuery –Introduction to AJAX-Bootstrap - Bootstrap Components.	12
V	**PHP** Introduction - How Web Works - Setting up the Environment (LAMP server) - Programming Basics Print/echo - Variables and Constants – Strings and Arrays – Operators, Control Structures and Looping Structures – Functions – Reading Data in Web Pages - Embedding PHP within HTML - Establishing Connectivity with MySQL Database	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Analyze the principles of SMTP, POP3, File Transfer Protocol, and HTTP and demonstrate the ability to distinguish between static and dynamic web pages and showcase HTML syntax and tags in the design process.

CO2: Apply CSS3 techniques, including backgrounds, text manipulation, positioning, and responsive design, with LESS/SASS for efficient stylesheet development.

CO3: Demonstrate proficiency in applying JavaScript principles, culminating in the ability to create dynamic web content and implement form validations.

CO4: Apply object-oriented techniques like constructors and prototypes, effectively utilizing JSON for data structure, employing jQuery and AJAX for enhanced interactivity,

CO5: Apply foundational PHP skills in web development by articulating programming basics and determining effective variable manipulation, leading to proficient connectivity with MySQL databases.

REFERENCE BOOKS :

R1. David Flanagan, "JavaScript: The Definitive Guide, Sixth Edition", O'Reilly Media, 2011

R2.Harvey& Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011

R3. James Lee, BrentWare, "Open-Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP" AddisonWesley, Pearson 2009

R4. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010

R5. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.

R6. Thomas A Powell, "Ajax: The Complete Reference", McGraw Hill, 2008

	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	Analyze the principles of SMTP, POP3, File Transfer Protocol, and HTTP and demonstrate the ability to distinguish between static and dynamic web pages and showcase HTML syntax and tags in the design process.	3	3	2	1	3	-	2	-	2	1	1	-
CO2	Apply CSS3 techniques, including backgrounds, text manipulation, positioning, and responsive design, with LESS/SASS for efficient stylesheet development.	3	3	2	1	3	-	2	-	-	2	1	-
CO3	Demonstrate proficiency in applying JavaScript principles, culminating in the ability to create dynamic web content and implement form validations.	3	3	2	1	3	-	2	-	1	1	1	-
CO4	Apply object-oriented techniques like constructors and prototypes, effectively utilizing JSON for data structure, employing jQuery and AJAX for enhanced interactivity,	3	3	2	1	3	-	3	-	-	1	1	-
CO5	Apply foundational PHP skills in web development by articulating programming basics and determining effective variable manipulation, leading to proficient connectivity with MySQL databases.	3	3	3	2	3	-	3	2	2	2	2	-
	CO PO Mapping Average Value	**3.0**	**3.0**	**2.2**	**1.2**	**3.0**	**-**	**2.4**	**2.0**	**1.7**	**1.4**	**1.2**	**-**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1202	COMPUTER NETWORKS	3	0	0	3

COURSE OBJECTIVE

1. To categorize network uses, communication models, and data transmission concepts to establish a foundational comprehension of network protocols, OSI, LAN topology, and transmission media.
2. To examine the functionality of flow control protocols, differentiate error detection mechanisms (parity check, checksum, CRC), and scrutinize error correction techniques (Hamming Code) for effective execution within the Data Link Layer
3. To appraise the effectiveness of switching concepts, compare circuit and packet switching, assess the hierarchical structure of IPv4 and IPv6 addresses, and critically evaluate the functionalities of routing protocols.
4. To compare the functions of the Transport Layer and contrast the mechanisms of flow control including the Sliding Window protocol and evaluate the divergent strategies employed for congestion control and avoidance.
5. To apply, Packet Tracer and cryptographic techniques and actively integrate them to configure and fortify the security of real-time applications.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**NETWORK FUNDAMENTALS** Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocols – OSI– LAN Topology - Transmission media.	9
II	**DATA LINK LAYER** Functions of Data link Layer - Flow Control Protocols – Error Detection – Parity check, Checksum & CRC - Error Correction - Hamming Code - Ethernet, Token ring, Wireless LAN.	9
III	**NETWORK LAYER** Switching concepts – Circuit switching – Packet switching –IPV4, IPV6 —IP address Hierarchy – ICMP – Routing Protocols – Distance Vector – Link State.	9
IV	**TRANSPORT LAYER** Functions of Transport Layer -, Connection Establishment, Connection Release, Flow Control – Sliding Window protocol, UDP, TCP, Congestion control and Avoidance.	9
V	**REAL TIME APPLICATIONS & NETWORK SECURITY** DHCP – LDAP – HTTP – HTTPS – Packet Tracer – Cryptography – Ciphers – RSA algorithm – Web Security & Threats.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Utilize the gained expertise to choose suitable transmission media, and deploy protocols for smooth communication across varied network environments.
CO2: Synthesize insights from the examination of flow control and error detection methods, categorize the application of error correction strategies.
CO3: Appraisal of switching concepts, discerning the merits and drawbacks of circuit and packet switching and to critically assess the hierarchical organization of IPv4 and IPv6 addresses, validating their respective applications
CO4: Contrast the efficiency of connection establishment and release processes and evaluate strategies for effective congestion control and avoidance.
CO5: Evaluate the efficacy of DHCP, Packet Tracer and cryptographic methods appreciating their distinctive roles in ensuring network security.

REFERENCE BOOKS:

R1 - Larry L. Peterson & Bruce S. Davie, "Computer Networks – A systems Approach", Fourth Edition, Harcourt Asia / Morgan Kaufmann, 2009
R2 - William Stallings, "Data and Computer Communications", Nineth Edition, Prentice Hall , 2011.
R3 - Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw Hill, 2014
R4 - Andrew S. Tannenbaum David J. Wetherall, "Computer Networks" Fifth Edition , Pearson Education 2011
R5 - James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition,2012

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Utilize the gained expertise to choose suitable transmission media, and deploy protocols for smooth communication across varied network environments.	3	3	1	1	3	1	3	-	-	-	-	-
CO2	Synthesize insights from the examination of flow control and error detection methods, categorize the application of error correction strategies.	3	3	2	1	3	2	2	-	-	-	-	-
CO3	Appraisal of switching concepts, discerning the merits and drawbacks of circuit and packet switching and to critically assess the hierarchical organization of IPv4 and IPv6 addresses, validating their respective applications	3	3	3	1	2	1	2	-	-	-	-	-
CO4	Contrast the efficiency of connection establishment and release processes and evaluate strategies for effective congestion control and avoidance.	3	3	2	2	3	1	3	-	-	-	-	-
CO5	Evaluate the efficacy of DHCP, Packet Tracer and cryptographic methods appreciating their distinctive roles in ensuring network security.	3	3	3	2	3	3	3	1	-	-	-	-
	CO PO Mapping Average Value	**3.0**	**3.0**	**2.2**	**1.4**	**2.8**	**1.6**	**2.6**	**1.0**	-	-	-	-

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1203	JAVA PROGRAMMING	3	1	0	4

COURSE OBJECTIVE

1. To apply Java features, bytecode understanding, operator implementation, and control structure utilization to develop a foundational understanding of Java programming.
2. To employ Java features such as nested classes, inheritance, access specifiers, encapsulation, and interfaces, demonstrating a practical grasp of Object-Oriented Programming concepts.
3. To utilize exception handling techniques, employing try-catch, nested try, throw, throws, and finally, to fortify Java programs against errors. Innovate by creating user-defined exceptions for enhanced error management.
4. To utilize Java Frames, integrate basic GUI components, and implement the Delegation Event Model to create interactive and visually appealing graphical user interfaces.
5. To implement I/O streams for reading/writing to the console, demonstrating the working mechanism of data input/output.

Pre-requisite – PoP and OOPs

Unit	Description	Instructional Hours
I	**INTRODUCTION** Java Features – The Byte Code – Operators- Control Structures - Class Fundamentals – Objects – Overloading Methods – Passing and returning objects – Recursion – Controlling access to members – this keyword - static and final keyword.	12
II	**OOPS** Nested classes – Inheritance – Using super keyword - Access specifier- Encapsulation-Interface-Polymorphism– Multi Level hierarchy – Method Overriding - Dynamic Method Dispatch – The Object class – Abstract classes - Packages – Access modifiers – Importing packages – Interfaces – Applying Interfaces-Abstraction-Package	12
III	**EXCEPTION HANDLING & THREADS** Exception handling – Using try catch – Nested try- throw – throws – finally – Built in exceptions – user defined exceptions - Threads – Thread model – Creating a thread – Thread priorities – Synchronization – Multithreading.	12
IV	**FRAMES & APPLETS** Java Frame – basic GUI components – Delegation event model - Event Classes– Source of events – Event Listener Interface – Applet Programming.	12
V	**FILES & DATABASES** I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Java Collections	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Evaluate the efficiency of utilizing class fundamentals, implementing object-oriented concepts, managing method overloading, and exploring recursion in Java programming

CO2: Assess the implementation of the super keyword, scrutinize access specifiers, execute encapsulation, and demonstrate proficiency in applying polymorphism through multi-level hierarchy and method overriding.

CO3: Implement and orchestrate threads, prioritize their execution, synchronize processes, and proficiently employ multithreading concepts in Java programming.

CO4: Implement the Delegation Event Model to handle events seamlessly, demonstrating proficiency in identifying event sources and applying Event Listener Interfaces.

CO5: Execute JDBC operations with databases, analyzing connectivity, querying, and updating processes for efficiency.

REFERENCE BOOKS:

R1- Herbert Schildt, "JAVA - The Complete Reference", Ninth Edition 2014, McGraw-Hill Education,
R2- RashmiKanta Das, "Core Java for Beginners", Third Edition, First Reprint 2015, Vikas Publishing House Pvt Ltd, ISBN – 978-93259-6850-9.
R3-Deitel, Deitel," Java How to Program", Tenth Edition, PHI, 2015

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Evaluate the efficiency of utilizing class fundamentals, implementing object-oriented concepts, managing method overloading, and exploring recursion in Java programming	3	2	3	1	3	-	-	-	-	-	-	-
CO2	Assess the implementation of the super keyword, scrutinize access specifiers, execute encapsulation, and demonstrate proficiency in applying polymorphism through multi-level hierarchy and method overriding.	3	3	3	1	3	2	2	3	-	-	-	-
CO3	Implement and orchestrate threads, prioritize their execution, synchronize processes, and proficiently employ multithreading concepts in Java programming.	2	2	2	2	3	1	2	2	-	-	-	-
CO4	Implement the Delegation Event Model to handle events seamlessly, demonstrating proficiency in identifying event sources and applying Event Listener Interfaces.	2	2	2	2	2	2	1	3	-	-	-	-
CO5	Execute JDBC operations with databases, analyzing connectivity, querying, and updating processes for efficiency.	2	2	2	2	3	1	2	2	-	-	-	-
	CO PO Mapping Average Value	**2.4**	**2.2**	**2.4**	**1.6**	**2.8**	**1.5**	**1.8**	**2.5**	-	-	-	-

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1204	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

COURSE OBJECTIVE

1. To employ database languages, and design database schemas, demonstrating proficiency in understanding and applying fundamental concepts of database architecture and data modeling.
2. To Evaluate and apply advanced relational algebra and SQL concepts to optimize relational database querying.
3. To Evaluate functional dependency and normalization principles for optimal relational database design.
4. To Analyze transaction processing and concurrency control methods, developing proficiency in their implementation.
5. To Evaluate and apply specialized database concepts, including complex data types, ODBMS, ORDBMS, and SQL features. Examine NoSQL databases for handling unstructured data.

Pre – requisite - Nil

Unit	Description	Instructional hours
I	**INTRODUCTION, DATABASE DESIGN AND RELATIONAL MODEL** Introduction-Database System Applications, Purpose of Database Systems, View of Data – Database Languages, Database and Application Architecture, Database Users and Administrators – Database Schema – Keys – Schema Diagrams - ER diagrams – Mapping Cardinalities – Alternatives Notations for Modeling Data – Data Flow Diagram.	9
II	**RELATIONAL ALGEBRA, INTRODUCTION TO SQL & INTERMEDIATE SQL** Relational Algebra - Selection and Projection, Set operations, Renaming, Introduction to SQL – DDL – DML Commands – Basic Structure of SQL Queries – Set Operations – Null Values – Aggregate Functions – **Nested Sub Queries** – Intermediate SQL – Joins, Views and Transactions.	9
III	**ADVANCED SQL – FUNCTIONAL DEPENDENCY & NORMAL FORMS** Advanced SQL – Exceptional Handling using PL/SQL – Triggers & Cursors – Functions and Procedures – Subquery – Independent sub query - Correlated Sub Query- Functional Dependency - Reasoning about FDS-Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).	9
IV	**TRANSACTION PROCESSING AND CONCURRENCY CONTROL** Introduction- Transaction Concepts- Concurrency Control- Locking Methods for Concurrency Control- Timestamp Methods for concurrency control- Optimistic Methods for concurrency control.	9
V	**SPECIALITY DATABASES & NO SQL DATABASE** Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance inSQL, Table Inheritance, Object-Identity and Reference Types in SQL.Unstructured database – NOSQL an Overview	9
	Total Instructional hours	**45**

COURSE OUTCOME

CO1: Create comprehensive Entity-Relationship (ER) diagrams using alternative notations, design effective database schemas with appropriate keys,

CO2: Execute relational algebra operations, employ SQL queries (DDL and DML), analyze set operations, aggregate functions, and nested subqueries.

CO3: Critically evaluate and apply functions, procedures, subqueries (independent and correlated), and functional dependency.

CO4: Demonstrate analytical skills in assessing the core concepts and proficiently implementing advanced techniques for effective database management.

CO5: Analyze and apply advanced concepts in specialized databases, demonstrating a deep understanding of complex data types, ODBMS, ORDBMS

REFERENCE BOOKS

R1. Abraham Silberschatz, H.F. Korth, S.Sudarshan -Data base System Concepts- McGraw Hill, VII edition, 2020. (Unit 1)
R2. Raghurama Krishnan, Johannes Gehrke-Data base Management Systems- McGraw-Hill Education, 3rd Edition, 2003.(Units 1,2,3)
R3. Shio Kumar Singh, Database Systems- Concepts, Designs and Application-Pearson Education, Second Edition, 2013. (Units 4,5).

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Create comprehensive Entity-Relationship (ER) diagrams using alternative notations, design effective database schemas with appropriate keys,	3	3	3	3	2	3	-	-	-	-	-	3
CO2	Execute relational algebra operations, employ SQL queries (DDL and DML), analyze set operations, aggregate functions, and nested subqueries.	3	3	-	1	3	2	3	-	3	-	-	-
CO3	Critically evaluate and apply functions, procedures, subqueries (independent and correlated), and functional dependency.	3	3	3	3	3	2	2	3	2	-	1	1
CO4	Demonstrate analytical skills in assessing the core concepts and proficiently implementing advanced techniques for effective database management.	3	3	3	3	3	2	3	3	1	-	2	2
CO5	Analyze and apply advanced concepts in specialized databases, demonstrating a deep understanding of complex data types, ODBMS, ORDBMS	3	3	3	2	3	3	3	2	2	2	1	3
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.4**	**2.8**	**2.4**	**2.8**	**2.7**	**2.0**	**2.0**	**1.3**	**2.3**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1001	JAVA PROGRAMMING LAB	0	0	3	1.5

COURSE OBJECTIVE	1.To design Java programs that utilize object-oriented principles 2.To build programs to learn inheritances, interface, packages, applets and graphics 3.To design Java programs using Windows, Applets, Graphics, and Swing to manipulate fonts, colors, and GUI components while demonstrating event handling proficiency 4. To illustrate various aspects of exception handling and I/O Streams 5. To demonstrate Multithreading concepts and perform database operations.

Pre-requisite – PoP and OOPs Lab

Unit	Description	Instructional hours
1	**OBJECTS, CLASSES AND COMMAND LINE ARGUMENTS** Write programs to define a class called Cone and find its area and volume. The area and volume is evaluated using the formula given below: Slant height = $\sqrt{r^2+h^2}$, Volume = $1/3\pi r^2h$, Area = $\pi*r*$slant height. a) The input data is given in the main method as hard coded. b) The input is given during the run time. The system must prompt the user to input the radius and slant height. c) The input is given in the command line. That is, while the run command is given, the data is also given in the command line. d) The program must be intelligent enough to repeat the process for any number of cone objects, depending upon the input data provided.	3
2	**ATTRIBUTES, METHODS, DATE AND ARRAY OF OBJECTS** i)Define a class Employee with the name and date of appointment. Create 5 employee objects as an array and print them as per their date of appointment, that is print them as per their seniority. ii) Write a program to create student class with the following attributes: Register number, Name of the student, Mark in sub1, Mark in sub2, Mark in sub3, Total marks. The total of the three marks should be calculated only if the student passes all the 3 subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects, his total marks must be declared as 0. Using these conditions write a constructor for this class. Write a method displayStudent() to display the details of the student object. In the main method create an array of 3 student objects and display the object details.	3
3	**INHERITANCES** i) In a retail inventory and billing system, the inventory items are defined as a class having the attributes. When the item is sold, a bill is produced. The bill may be for several items bought. Among the items certain items are taxable when sold. Write a program to prepare the bill for the sale of items. Illustrate inheritance of classes. a)Single Inheritance. b) Multilevel inheritance. c) Hierarchical Inheritance.	3
4	**INTERFACE AND PACKAGE** i) Compile the interface Swimmer that contains getMaxDepth(), getMaxSpeed() and the interface Driver getDriverLicense() and getVIN(). Then write and test the class that implements both the interfaces. (VIN=Vehicle Identification number). ii) Create a simple Book class that is contained within a package called bookpack. Use import to bring the bookpack package into view so that the Book class can be used. Create array of objects for the Book class to get the input.	3
5	**WINDOWS, APPLETS AND GRAPHICS** **i)Font and FontMetric class:** Using **Frame**, display one line of text which has three different types of font. **ii)Color class:** Write a class called color checking. Define a color with red=193, green=255, and blue=183. Now separate the rgb values. Find the hue, saturation and brightness of this color. **iii)Applet:** Using Applet, display one line of text which has three different types of font. **iv)Graphics:** Write a java program to draw the figure of a lamp.	6

6	**EXCEPTION HANDLING** i) Demonstrate ArithmeticException, ArrayIndexOutOfBoundsException, Multiple Catch Clauses, Catching subclass Exception, Nested try, throwing an exception, finally, throws. ii) Custom Exception: Consider a simple Student class with only three attributes name, mark and result. In this class we are going to define a constructor and findAndDisplayResult()method. This method will check whether the mark is < 50. If so, the candidate fails and otherwise he passes. The method must also do data validation work. If the mark is greater than 100, it means that some typographical error has occurred. So, the method must throw an exception MarkOutOfBoundsException. This exception has only one attribute called mark. Develop a custom exception as mentioned.	6
7	**EVENT HANDLING WITH SWING** **i)**Create a GUI form for a customer in car show room to input/select the car model and other specifications and display the details read. Utilize maximum possible swing components to demonstrate event handling. **ii)Adapter Class:** Using the Adapter class MouseAdapter, execute mousePressed and mouserReleased events.	6
8	**I/O** Write a program that copies a text file. The names of the source and destination files are specified on the command line.	3
9	**MULTITHREADING** i) Create a main thread that can spawn three child threads. ii) Demonstrate synchronization by controlling access to a method sumArray() which sums the elements of an integer array for 2 child threads.	6
10	**DATABASE** Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so.	6
	Total Instructional hours	**45**

COURSE OUTCOME

CO1: Develop Java programs that demonstrate proficiency in class design, input handling, array manipulation, and object-oriented programming concepts

CO2: Design and implement programs using various inheritance structures, interfaces and packages, showcasing proficiency in encapsulation and modular programming.

CO3: Create Java applications that showcase graphical and event-driven programming, emphasizing font and color manipulation, figure drawing, Swing-based GUI forms, and event handling with the Adapter class.

CO4: Develop Java programs showcasing proficiency in handling exceptions and I/O stream operations.

CO5: Create a GUI-based application that effectively interacts with a database, demonstrating proficiency in performing database operations using Java and multithreading concepts.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop Java programs that demonstrate proficiency in class design, input handling, array manipulation, and object-oriented programming concepts	3	3	3	3	3	2	2	-	3	1	2	2
CO2	Design and implement programs using various inheritance structures, interfaces and packages, showcasing proficiency in encapsulation and modular programming.	3	3	3	2	3	2	3	-	3	1	2	2
CO3	Create Java applications that showcase graphical and event-driven programming, emphasizing font and color manipulation, figure	3	3	3	2	3	2	3	-	2	1	2	2

	drawing, Swing-based GUI forms, and event handling with the Adapter class.												
CO4	Develop Java programs showcasing proficiency in handling exceptions and I/O stream operations.	3	3	3	2	3	2	3	-	2	1	2	2
CO5	Create a GUI-based application that effectively interacts with a database, demonstrating proficiency in performing database operations using Java and multithreading concepts.	3	3	3	2	3	2	3	-	3	1	2	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.2**	**3.0**	**2.0**	**2.8**	-	**2.6**	**1.0**	**2.0**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1002	DATABASE MANAGEMENT SYSTEM LABORATORY	0	0	3	1.5

COURSE OBJECTIVE

1. To give a better insight about ER and DFD.
2. To execute DDL, DML, DCL, and TCL commands, SQL functions, various joins, and subqueries for effective database management.
3. Apply normalization techniques to design a relational database for a scenario, ensuring data integrity, minimizing redundancy, and improving query efficiency.
4. To enhance proficiency in PL/SQL programming, covering key concepts such as Exception Handling, Cursors, Functions, and Triggers, for effective database application development.
5. Understand the principles, features, and usage of NoSQL databases for effective data storage and retrieval.

Pre -requisite - Nil

S.no	Description of the experiments	practical hours
1	Implement the Installation process of any database from scratch.	3
2	Draw ER Diagram for an Application.	6
3	Construct DFD for an Application.	6
4	Execute a DDL, DML, DCL and TCL commands for a Table	3
5	Execute SQL Functions	3
6	Execute various Joins and Sub Queries	3
7	Given an Scenario, Apply Normalization at all levels.	6
8	Write PL/SQL Procedure for an application using Exception Handling	3
9	Write PL/SQL Procedure for an application using Cursors.	3
10	Write a PL/SQL program for an application using Functions.	3
11	Write a PL/SQL block for transaction operations of a typical application using Triggers	3
12	Exercise using NoSQL Database	3
	Total Instructional hours	**45**

COURSE OUTCOME

CO1: Design and implement a relational database, demonstrating proficiency in ER modeling, and develop the data flow process through DFD.
CO2: Proficient in using SQL commands, functions, and advanced querying techniques to manipulate and retrieve data from relational databases.
CO3: Analyze and normalize database structures, producing well-organized tables that adhere to First, Second, and Third Normal Forms, promoting effective data management and reducing data anomalies.
CO4: Create applications using PL/SQL programming, with practical skills for building robust and efficient database applications.
CO5: Proficient in NoSQL concepts, possess hands-on experience in data modeling, storage, retrieval, and querying using MongoDB, and understand the scalability and performance aspects of NoSQL databases.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design and implement a relational database, demonstrating proficiency in ER modeling, and develop the data flow process through DFD.	3	3	3	3	3	2	3	1	3	2	2	3
CO2	Proficient in using SQL commands, functions, and advanced querying techniques to manipulate and retrieve data from relational databases.	3	3	3	3	3	2	3	1	2	1	2	2
CO3	Analyze and normalize database structures, producing well-organized tables that adhere to First, Second, and Third Normal Forms, promoting effective data management and reducing data anomalies.	3	3	3	3	3	2	3	1	2	2	2	2
CO4	Create applications using PL/SQL programming, with practical skills for building robust and efficient database applications.	3	3	3	3	3	2	3	1	2	1	2	1
CO5	Proficient in NoSQL concepts, possess hands-on experience in data modeling, storage, retrieval, and querying using MongoDB, and understand the scalability and performance aspects of NoSQL databases	3	3	3	3	3	2	3	1	2	1	2	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**1.0**	**2.2**	**1.4**	**2.0**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1171	COMMUNICATION SKILL FOR BUSINESS ENGLISH	0	0	2	2

COURSE OBJECTIVE

1. Apply phonetic principles and speech sounds, transcribe vowels and consonants to enhance language proficiency.
2. Evaluate and implement past tense and plural markers for advanced pronunciation skills.
3. Demonstrate proficiency in syllable and syllabification, enhancing language fluency.
4. Analyze word stress, intonation, and transfer visual information to verbal communication.
5. Evaluate and rectify pronunciation errors, accent, and mother tongue influence.

Unit	Description	Instructional Hours
I	**DESCRIBE BASIC COMMUNICATION PRINCIPLES & PLAN FOR EFFECTIVE COMMUNICATION** Identify professional communication skills- Identify effective verbal, nonverbal, and listening skills- Analyze the effect of the audience on a message - Analyze the effect of the environment on a message - Given a communication scenario, identify the specific purpose - Given a communication scenario, address ethical and legal issues	9
II	**PLAN FOR EFFECTIVE COMMUNICATION & APPLY BEST PRACTICES FOR CREATING BUSINESS DELIVERABLES** Given a business scenario, select the most appropriate communication medium - Effectively outline and summarize your message - Assemble accurate business communication deliverables - Apply visual design standards to business communications - Identify effective uses of data visualization to present complex information	9
III	**DELIVER YOUR MESSAGE** Describe the variables involved in delivering an effective message - Identify methods of adapting a message based on audience feedback	9
IV	**RECEIVE COMMUNICATIONS** Given a business communication, restate the key points of the –message - Given a message, identify appropriate responses or clarifying-questions	9
V	**ANALYZE COMMUNICATION SCENARIOS** Analyze important factors of obtaining employment- Analyze expressions of and responses to feedback- Analyze communication etiquette within a business hierarchy- Given a customer service request, identify the problem, solution, and appropriate action	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Know the basics of various ways to communicate a message to the receiver
CO2 Apply the best communication method and use it effectively
CO3: Evaluate different methods of application of message and modify it according to the feedback received
CO4: Reiterate the received message and ensure that it has been received in the right context and explain it again wherever necessary.
CO5: Participate effectively in formal or informal conversations, message sharing and resolving issues and complaints and reporting of the issues

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Know the basics of various ways to communicate a message to the receiver	-	1	1	1	3	1	1	3	3	1	3	1
CO2	Apply the best communication method and use it effectively	-	1	3	-	3	3	1	3	3	3	3	2
CO3	Evaluate different methods of application of message and modify it according to the feedback received	-	1	-	1	3	-	1	3	3	-	3	-
CO4	Reiterate the received message and ensure that it has been received in the right context and explain it again wherever necessary	-	1	-	-	3	-	1	3	3	-	3	-
CO5	Participate effectively in formal or informal conversations, message sharing and resolving issues and complaints and reporting of the issues	-	1	2	-	3	2	1	3	3	2	3	2
	CO PO Mapping Average Value	**-**	**1.0**	**2.0**	**1.0**	**3.0**	**2.0**	**1.0**	**3.0**	**3.0**	**2.0**	**3.0**	**1.7**

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SEMESTER II

Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2201	DATA STRUCTURES AND ALGORITHMS	3	1	0	4

COURSE OBJECTIVE

1. To implement advanced concepts in linear data structures, including abstract data types, arrays, pointers, dynamic memory allocation, structures, linked lists, stacks, queues, and recursion, for effective problem-solving.
2. To apply advanced non-linear data structure concepts, including sorting (insertion, selection, merge, quick, heap), searching (linear, binary), hashing, and string-matching algorithms for effective problem-solving.
3. To employ advanced concepts in non-linear data structures, including trees and graphs using Minimum Cost Spanning Tree algorithms.
4. To execute advanced algorithm design and analysis techniques, including Greedy Strategy Dynamic Programming and Backtracking.
5. Understand the concepts of P, NP, NP-Complete, and NP-Hard, with a focus on graph problems, scheduling problems, and code generation problems.

Pre-requisite – 21CA1291 PoP and OOPs

Unit	Description	Instructional hours
I	**LINEAR DATA STRUCTURES** Introduction: Data Type- Abstract Data types- Data Structures- Arrays- Pointers- Dynamic Memory Allocation-Structures- Linked Lists- Stacks and Queues- Recursion.	12
II	**NON-LINEAR DATA STRUCTURES- SORTING, SEARCHING AND HASHING** Insertion Sort, Selection Sort, Merge-Sort, Quick Sort, Heap Sort, Linear & Binary Search, Hashing, Chaining, String matching algorithms: Knuth-Morris- Pratt algorithm- The Naive String-Matching Algorithm	12
III	**NON-LINEAR DATA STRUCTURE- TREES AND GRAPHS.** Trees: BST, AVL Trees, R B Trees, B Trees, B+ Tree definition, properties and their operations; Graph : Undirected & Directed Graph-Graph Terminology- Connectivity in undirected & Directed graph -Breath First Search, Depth First Search, Minimum Cost Spanning Tree algorithms- Prim's, Kruskal's	12
IV	**ALGORITHM DESIGN AND ANALYSIS** Greedy Strategy: KnapSack Problem, Single Source Shortest Path, Huffman Coding; Dynamic programming: Traveling Salesperson Problem (TSP), Longest Common Subsequence & All Pair Shortest Paths; Backtracking: The 8-Queens Problem, Sum of Subsets; Branch and Bound: TSP	12
V	**NP-HARD AND NP-COMPLETE** Basic Concepts: P, NP, NP Complete, NP-Hard Graph Problems, NP Hard Scheduling Problems, NP- Hard code generation problems.	12
	Total Instructional hours	**60**

COURSE OUTCOME

CO1: Demonstrating a deep understanding of linear data structure concepts and applying them to solve complex problems.
CO2: Utilize and implement non-linear data structures, showcasing a deep understanding of sorting, searching, hashing principles, and string-matching algorithms.
CO3: Execute a deep understanding of trees and graphs and utilize Breadth-First Search and Depth-First Search showcasing comprehensive problem-solving skills.
CO4: Demonstrate a profound understanding of Greedy Strategy, Dynamic Programming, Backtracking, and Branch and Bound methods.
CO5: Analyze and synthesize fundamental concepts related to computational complexity, including P, NP, NP-Complete, and NP-Hard.

REFERENCE BOOKS :

R1. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed- Fundamentals of Data Structures in C – Second Edition- University Press India Pvt Ltd, Hyderabad- 2017.
R2. Yashavant Kanetkar- Data Structures through C- Second Edition- BPB Publications, India- 2009.
R3. S. K. Srivastava & Deepali Srivastava-Data Structures through C in Depth-Second Revised & Updated Edition-BPB Publications, New Delhi- 2011.
R4. A. Puntambekar- Data Structures and Algorithms- Second Revised Edition- Technical Publications, Pune- 2020.
R5. Seymour Lipschutz- Data Structures with C- Schaum's Outlines- Special Indian Edition- Tata McGraw-Hill Education (India) Pvt Ltd, Chennai- 20th reprint 2017. (For Problems)
R6. Marcello La Rocca, Advanced Algorithms and Data Structures, Manning Publications, 2021.

Benjamin Baka, Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition 2018 Kindle Edition.
R7. Robert Lafore, Data Structures and Algorithms in Java, SAMS Publication, 2017.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Demonstrating a deep understanding of linear data structure concepts and applying them to solve complex problems.	3	3	3	3	3	3	3	1	3	-	2	2
CO2	Utilize and implement non-linear data structures, showcasing a deep understanding of sorting, searching, hashing principles, and string-matching algorithms.	3	3	3	2	3	2	2	2	2	-	2	2
CO3	Execute a deep understanding of trees and graphs and utilize Breadth-First Search and Depth-First Search showcasing comprehensive problem-solving skills.	3	3	3	3	3	1	2	1	2	2	2	2
CO4	Demonstrate a profound understanding of Greedy Strategy, Dynamic Programming, Backtracking, and Branch and Bound methods.	3	3	3	2	3	1	3	1	2	2	2	2
CO5	Analyze and synthesize fundamental concepts related to computational complexity, including P, NP, NP-Complete, and NP-Hard.	3	3	3	2	3	1	3	1	2	2	2	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.4**	**3.0**	**1.6**	**2.6**	**1.2**	**2.2**	**2.0**	**2.0**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2202	ARTIFICIAL INTELLIGENCE	3	1	3	4

COURSE OBJECTIVE

1. To assess advanced concepts in artificial intelligence, focusing on intelligent agents, their interactions with environments.
2. To implement advanced searching techniques and logical reasoning in artificial intelligence, focusing on constraint satisfaction problems (CSP) with backtracking search and local search.
3. To examine syntax and semantics for first-order logic, explore knowledge engineering, and delve into inference techniques such as unification, lifting, forward chaining, backward chaining, and resolution.
4. To explore the planning problem, incorporating state-space search, partial order planning, graphs, and planning with propositional logic.
5. To explore knowledge in learning, logical formulation of learning, explanation-based learning,.

Pre-requisite – 21MA1101 Probability and Statistics, Operation Research

Unit	Description	Instructional hours
I	**AGENTS AND SEARCHING TECHNIQUES** **Introduction:** Definition of AI. Intelligent Agents: Agents and environments - Good behavior – The nature of environments – structure of agents. **Problem solving agents**: Formulating problems – searching for solutions – Iterative deepening depth-first search. **Informed search and exploration**: Informed search strategies – heuristic functions – local search algorithms – local search in continuous spaces – online search agents and unknown environments.	12
II	**SEARCHING TECHNIQUES AND LOGICAL AGENTS** **Constraint satisfaction problems (CSP)**: Backtracking search and Local search for CSP – Structure of problems. **Adversarial Search:** Games – Optimal decisions in games – Alpha–Beta Pruning –imperfect, real – time decisions–games that include an element of chance. **Logical agents:** Knowledge-based agents – The Wumpus world- Logic – Propositional logic-reasoning patterns in Propositional logic-effective propositional inference–agents based on Propositional logic.	12
III	**KNOWLEDGE AND REASONING** **First order logic** : Representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic. **Inference in First order logic:** propositional versus first order logic–unification and lifting–forward chaining – backward chaining – Resolution. **Knowledge representation**: Ontological Engineering – Categories and objects– Actions, situations and events -Mental events and mental objects.	12
IV	**PLANNING, REASONING AND LEARNING** **Planning:** The planning problem- planning with state-space search-partial order planning-graphs –planning with propositional logic. **Making simple decisions:** The basis of Utility theory–Utility and multi attribute utility functions– decision networks– The value of information – Decision theoretic expert systems. **Learning from observations:** Forms of learning - Inductive learning –Learning decision trees –Ensemble learning	12
V	**LEARNING AND COMMUNICATION** **Knowledge in learning** – Logical formulation of learning – Explanation based learning – Learning using relevant information –Inductive logic programming. **Statistical learning methods**: Neural networks **Reinforcement learning:** Passive reinforcement learning-Active reinforcement learning- Generalization in reinforcement learning. **Communication:** Communication as action – Formal grammar for a fragment of English – Syntactic analysis–Augmented grammars –Semantic interpretation–Ambiguity and disambiguation–Discourse understanding – Grammar induction	12
	Total Instructional hours	**60**

COURSE OUTCOME

CO1: Analyze and apply concepts related to intelligent agents, recognizing their interactions with diverse environments and exhibiting good behavior.

CO2: Apprise the use searching techniques to address constraint satisfaction problems, employing both backtracking search and local search methods.

CO3: Demonstrate a deep understanding of inference techniques, comparing propositional and first-order logic, and applying unification, lifting, forward chaining, backward chaining, and resolution.

CO4: Effectively analyze decision-making using utility theory, multi-attribute utility functions, decision networks, and the value of information.

CO5: Assimilate learning methodologies, including logical formulation, explanation-based learning, and inductive logic programming, demonstrating a deep understanding of knowledge in learning.

REFERENCES BOOKS:

R1. David L. Poole and Alan K. Mackworth , Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2017.

R2. Stuart Russell and Peter Norvig , Artificial Intelligence: A Modern Approach", Pearson Publishing, 2020 (Fourth Edition).

R3. David L. Poole, Alan K. Mackworth, Artificial Intelligence Foundations of Computational Agents, Cambridge University Press, 2017.

R4. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction", The MIT Press, 2018.

R5. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press, 2014.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Analyze and apply concepts related to intelligent agents, recognizing their interactions with diverse environments and exhibiting good behavior.	3	3	3	1	3	3	3	1	3	-	1	2
CO2	Apprise the use searching techniques to address constraint satisfaction problems, employing both backtracking search and local search methods.	3	3	3	2	3	2	2	2	2	-	2	2
CO3	Demonstrate a deep understanding of inference techniques, comparing propositional and first-order logic, and applying unification, lifting, forward chaining, backward chaining, and resolution.	3	3	3	1	2	1	2	1	2	-	2	1
CO4	Effectively analyze decision-making using utility theory, multi-attribute utility functions, decision networks, and the value of information	3	3	3	2	3	1	3	1	2	-	2	2
CO5	Assimilate learning methodologies, including logical formulation, explanation-based learning, and inductive logic programming, demonstrating a deep understanding of knowledge in learning.	3	3	3	2	3	1	3	1	2	2	1	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**1.6**	**2.8**	**1.6**	**2.6**	**1.2**	**2.2**	**2.0**	**1.6**	**1.8**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2203	PYTHON PROGRAMMING	3	1	0	4

COURSE OBJECTIVE

1. To develop an understanding on the basic concepts of Python Fundamentals
2. To learn and apply various data structures (lists, tuples, sets, dictionaries) and functions in Python.
3. To explore advanced Python features, including exception handling, classes, objects, and basic web application structure.
4. To gain proficiency in creating visualizations using Matplotlib and Seaborn.
5. To examine Numpy and Pandas for data manipulation and explore basics of machine learning with SKLearn.

Pre-requisite – 21CA1291 PoP and OOPs

Unit	Description	Instructional Hours
I	**Module 1** Python – Features – Setting up the environment – IDE, Anaconda, Pycharm, Jupyter, Spyder– Keywords – Identifiers - Input & Output Statements – Data types – Conditional checking and branching – Conditional checking and looping – Else statement – Break & Continue	12
II	**Module 2** Lists – Tuples – Set – Dictionaries– Strings - Regular Expressions - Functions – Lambda – Packages	12
III	**Module 3** Exception handling – Classes and Objects – Inheritance –Composition - Basic Web Application Structure –Templates – Web Forms – Databases	12
IV	**Module 4** Principles of Information Visualization – Introduction to MatplotLib–Charts for Qualitative and Quantitative Analysis (Inclusive of Line, Scatter, Bar, Histogram, Pie, Box, Subplots, Violin plots, Mesh grid etc.,) – Exploration of Pyplot and Seaborn Libraries	12
V	**Module 5** Introduction to Numpy and Pandas – Aggregate functions – Loading and saving datasheets – Introduction to SKLearn – Missing Value Analysis – Normalization – Splitting to Training and Testing – Implementation of Model – Error Metrics	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Gain proficiency in basic Python programming, allowing the execution of simple tasks and problem-solving.
CO2: Design applications using basic data structures of Python and Regular Expressions.
CO3: Develop skills in handling exceptions, working with classes and objects, and creating basic web applications with database connectivity.
CO4: Develop the ability to represent and interpret data visually through a variety of charts and plots.
CO5: Perform Exploratory Data Analysis on a data set and implement machine learning models, and evaluate model performance using error metrics.

REFERENCE BOOKS:

R1- Ryan Marvin, Mark Nganga, Amos Omondi, "Python Fundamentals", Packt Publishing 2018
R2- Dave Kuhlman, A Python Book: Beginning Python, Advanced Python, and Python Exercises, Open-Source MIT License, 2013.
R3 - Samir Madhavan, Mastering Python for Data Science, Packt Publishing, 2015
R4 - Jake Vander Plas, Python Data Science Handbook, Essential Tools for Working with Data, O'Reilly Media, Inc., 2017
R5 – Arun Ravindran, Samuel Dauzon Aidas Bendoraitis, Django: Web Development with Python, Packt Publishing, 2017
R6 - Miguel Grinberg, Flask Web Development, 2nd Edition, O'Reilly Media, Inc., 2018.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Gain proficiency in basic Python programming, allowing the execution of simple tasks and problem-solving.	3	3	3	2	3	3	3	2	3	-	2	2
CO2	Design applications using basic data structures of Python and Regular Expressions.	3	3	3	2	3	2	2	2	2	-	2	2
CO3	Develop skills in handling exceptions, working with classes and objects, and creating basic web applications with database connectivity.	3	3	3	2	3	1	2	2	2	-	2	2
CO4	Develop the ability to represent and interpret data visually through a variety of charts and plots.	3	3	3	2	3	2	3	2	2	-	2	2
CO5	Perform Exploratory Data Analysis on a data set and implement machine learning models, and evaluate model performance using error metrics.	3	3	3	2	3	2	3	2	3	-	2	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2.0**	**2.6**	**2.0**	**2.4**	**-**	**2.0**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21EC2231	EMBEDDED SYSTEM AND SENSORS	3	0	2	3

Course Objective

1. Understand the basics of 8051 microcontroller architecture.
2. Understand the embedded C programming for 8 bit Microcontroller and RTOS Concepts
3. To learn about ARM processor architecture and its fundamentals.
4. Understand the concept of various microcontroller interfacing.
5. Understand basic concepts of sensors and actuators.

Pre-Requisite – Nil

Unit	Description	Instructional hours
I	**8051 MICROCONTROLLER** Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) - Timer – Interrupts - Addressing Modes – Instruction Set – Assembly Language Programming.	9
II	**EMBEDDED C PROGRAMMING** Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.	9
III	**ARM ARCHITECTURE** Acorn RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM 9 instruction set- Thumb Instruction set - The ARM Programmer's model.	9
IV	**INTERFACING TECHNIQUES** LED Interfacing - LCD & Keyboard Interfacing – ADC - DAC - Sensor Interfacing - Stepper Motor Interfacing – Traffic light Controller.	9
V	**INTRODUCTION TO SENSORS AND ACTUATORS** Classification of Sensors and Actuators - Input and Output Characteristics - Sensors and Actuators- working principle of Electric and Magnetic, Mechanical, Acoustic, Chemical Radiation and Temperature- Smart Sensors and Actuators.	9
	Total Instructional hours	**45**

Course Outcome

CO1: Write assembly language programs for 8051 Microcontroller.
CO2: Apply the Embedded C Programming and RTOS Concepts to various applications.
CO3: Create and test assembly level programming for ARM Processors
CO4: Explain various interfacing techniques using microcontroller.
CO5: Describe the development and applications of sensors and actuators

TEXT BOOKS:

T1. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education, 2014
T2. Nathan Ida, "Sensors, Actuators, and their Interfaces - A Multidisciplinary Introduction", Scitech Publishing, 2014.
T3. The 8051 Microcontroller and Embedded Systems – Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, 2nd Edition, Pearson Education, 2009.

REFERENCES:

R1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
R2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, First Edition, 2006.
R3. Kenneth J. Ayala, "The 8051 Microcontroller", Thomson/Cengage Learning, 2005

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Write assembly language programs for 8051 Microcontroller.	3	3	3	3	2	1	2	2	1	3	1	2
CO2	Apply the Embedded C Programming and RTOS Concepts to various applications.	3	3	3	1	3	1	2	2	2	3	1	2
CO3	Create and test assembly level programming for ARM Processors	3	3	3	3	2	1	2	2	2	2	2	3
CO4	Explain various interfacing techniques using microcontroller.	3	3	3	2	3	-	3	2	1	2	1	2
CO5	Describe the development and applications of sensors and actuators	3	3	3	2	3	-	3	2	2	2	1	3
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.2**	**2.6**	**1.0**	**2.4**	**2.0**	**1.6**	**2.4**	**1.2**	**2.4**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2001	PYTHON PROGRAMMING LAB	0	0	3	1.5

COURSE OBJECTIVE

1. To develop Python programs using control Structures and various Data Structures.
2. To develop Python programs using Strings, Functions, Regular Expressions and Packages
3. To develop programs using Exception Handling, Object Oriented Programming and web development and database connectivity using Python.
4. To Perform Visualization and perform data analysis using Numpy and Pandas
5. To develop Model for Machine Learning Algorithms

Pre-requisite – 21CA1091 PoP and OOPs Lab

S.no	Description of the experiments	practical hours
1	**Develop programs to understand the control structures of python** FoodCorner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo. Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below: **Distance in kms** / **Delivery charge in Rs per km** For first 3kms / 0 For next 3kms / 3 For the remaining / 6 Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer: • Type of food must be 'V' for vegetarian and 'N' for non-vegetarian. • Distance in kms must be greater than 0. • Quantity ordered should be minimum 1. If any of the input is invalid, the bill amount should be considered as -1.	3
2	**Develop programs to learn different types of structures (list, dictionary, tuples) in python** Mohan has got lot of friends all around the world. All of them have the interesting habit of sending letters to each other to express their feelings. Mohan has the practice of keeping all the stamps pasted on the letters safely. On every New Year day, he arranges all the stamps of preceding year according to the month of arrival, puts it on a small cover (stamps of four months are put in same cover) and indexes it with numbers. For example, 1 to represent January to April, 2 to represent May to august etc,. Along with the index, the number of stamps for those months is also stored. He then puts everything in a big cover and labels it with year number. At the age of 35, he has got around 3 such covers labeled with years of arrival. Mohan's cute son wants to see how many stamps he has collected in August '2007. Help him to find out by writing a python code. (Assume that the covers are not in sequence).	6
3	**Strings & Functions** The details of all employees (ID no, name, mobile number) of a company XYZ is stored and maintained by the company's IT department. On his birthday, the GM of the company wants to surprise a few of his employees with experience more than five years and whose ID number is	6

divisible by 5 by giving Rs.5000. He instructs the IT department to display the mobile number along with the name of all employees who are eligible for gift. Write a program to automate the selection and intimation. Name of a person is in the form initial (One letter), dot and any number of alphabets, spaces. Check the validity of the name entered and validity of the mobile number. A valid mobile number must consist of 10 digits and the first digit must not be zero. Print 'Invalid input' when conditions are not satisfied and break the process of getting input. Use functions.

Regular Expressions & Packages

4 Automatic toll collection centers scan the vehicle's number plate and check whether the vehicle belongs to Tamilnadu (TN) or Kerala (KL). The structure of a vehicle number is as follows: Two alphabets indicating the state, followed by two numbers representing the code of registration centre. This is followed by two alphabets and two numbers representing the sequence of registrations. Example: TN12 AL1143 is a valid no whereas TN12 A123 is not valid. Write a Python program to check whether the vehicle number scanned is valid and hence check whether the vehicle belongs to TN or KL. 6

Exception Handling

5 Online shopping website 'X' sells many interesting items by showing thecatalogs. The users can give the item code (a six character string with three alphabets followed by three digits), quantity required (number) and the color (string) required. Write a program using Python that prompts the user all these details and displays the total amount to be paid inclusive of shipping fee Rs.50/-. (Assume cost of each individual item). All inputs are to be validated based on given condition and exceptions to be thrown accordingly. 3

Object Oriented Programming in Python

6 User convenience becomes the mandatory reason for updates in any industry. Mobile phone industry is fast growing with updated functionalities for every new model. For eg., Earlier model of mobile phones has the provision to store only first name whereas recent mobile phones come with the provision to add firstname, middlename and lastname. But, it's a condition that all mobile phone models should have the provision to store atleast first name.
The software for managing user interface should possess the capability to support all the mobile phone models. Assuming that the user interface for mobile phones is designed using JAVA, write a program that can store and display the names in the below format depending upon the input from the user. 3

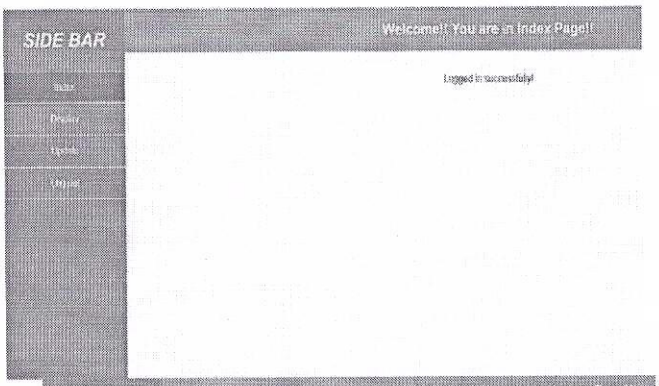
For eg., if the input is "Wolfgang", then the output will be Wolgnagf.

If the input has three strings i.e., Wolfgang, Amadeus, and Mozart, then the output should be WolsuedamAMozart.

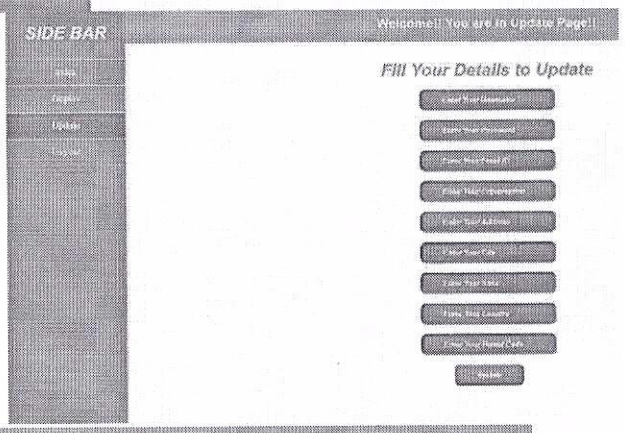
7 Create a Profile Application Page using any web development tool with database connectivity. The details of the Pages are given below.

Registration Page

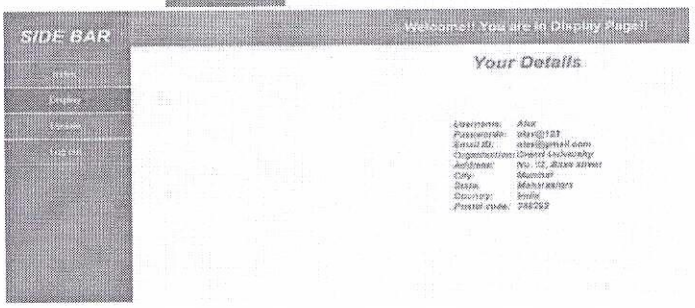
Index Page



Update page



Display page



Logout page LOGGED OUT SUCCESSFULLY

Visualization – Qualitative and Quantitative Analysis

8 Design and plot an informative chart(s) for visualizing the comparison between region-wise sales, region-wise profit and region-wise discount of super-store dataset. The plot should have a minimum of five numerical information for better understanding of data. Dataset may be downloaded from https://www.kaggle.com/juhi1994/superstore 6

Numpy and Pandas

9
1. Download pokeman dataset from https://www.kaggle.com/rounakbanik/pokemon and load it in a dataframe.
2. Check for the details of columns and analyse by printing the details of data.
3. Check for missing values and if present fill those with the median of each feature.
4. Find out the presence of outliers and remove them if present in the data.
5. Use boxplot for visualizing the range of values present in the features.
6. Visualize the correlation between the various features of the dataset.
7. Remove the columns with minimum relationship between each other.
8. Use swarmplot for visualization.

6

Model Implementation

10 A sample dataset about the various crimes is given below. Develop a suitable model with appropriate machine learning algorithm for a meaningful inference using Python. Justify your selection. 6

Person	Murder	Assault	Urban Pop	Theft
P1	13.2	236	58	21.2
P2	10.0	263	48	44.5

P3	8.1	294	80	31.0
P4	8.8	190	50	19.5
P5	9.0	276	91	40.6
P6	7.9	204	78	38.7
P7	3.3	110	77	11.1
P8	5.9	238	72	15.8
P9	15.4	335	80	31.9
P10	17.4	211	60	25.8
P11	5.3	46	83	20.2
P12	2.6	120	54	14.2
P13	10.4	249	83	24.0
P14	7.2	113	65	21.0
P15	2.2	56	57	11.3

Total Instructional hours 45

COURSE OUTCOME

CO1: Develop python programs using control structures and various data structures.
CO2: Develop simple applications using Strings, functions, Regular Expressions and Packages.
CO3: Develop object-oriented programs in python with Exceptional Handling and web development using database connectivity.
CO4: Create Visualization and perform data analysis using various tools.
CO5: Apply various Machine Learning model Algorithms for a given data set and provide meaningful inferences

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop python programs using control structures and various data structures.	3	3	3	2	2	-	2	-	-	-	-	2
CO2	Develop simple applications using Strings, functions, Regular Expressions and Packages.	3	3	3	2	3	-	2	-	2	-	-	2
CO3	Develop object-oriented programs in python with Exceptional Handling and web development using database connectivity.	3	3	3	2	2	-	2	-	2	-	-	3
CO4	Create Visualization and perform data analysis using various tools.	3	3	3	2	3	2	2	-	2	1	-	3
CO5	Apply various Machine Learning model Algorithms for a given data set and provide meaningful inferences	3	3	3	2	3	2	1	1	2	1	-	3
	CO PO Mapping Average Value	**3.0**	**3.0**	**3.0**	**2.0**	**2.6**	**2.0**	**1.8**	**1.0**	**2.0**	**1.0**	**-**	**2.6**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2002	DATA STRUCTURE AND ALGORITHMS LAB	0	0	3	1.5

COURSE OBJECTIVE

1. Demonstrate fundamental data structures such as stacks and queue.
2. Understand and implement fundamental data structures, including queues, linked lists, and trees, using array and pointer-based approaches.
3. Implement popular sorting algorithms, such as Merge Sort and Quick Sort, and develop searching algorithms for efficient data retrieval.
4. Implement traversal algorithms for graphs (DFS and BFS) and understand the operations involved in binary trees, AVL trees, and graph representations.
5. Solve complex problems, such as the N Queens' problem and Dijkstra's algorithm, using algorithmic design principles.

Pre-requisite – 21CA1091 PoP and OOPs Lab

S. No	Program	Hours
	Data Structures and Algorithms Lab	
1.	Write a C program for array implementation of stack and queue.	3
2.	Perform the following operations on a single linked list using C. i) Creation of a linked list ii) Traversing a linked list iii) Searching an element iv) Insertion of an element v) Deletion of an element vi) Reversal of a linked list.	6
3.	Write a C program of sorting using merge sort through recursion.	3
4.	Write a C program of sorting using quick sort.	3
5.	Write a C program for creation of a binary tree and display the tree in order, preorder and post order traversals.	6
6.	Write a C program to AVL trees (insertion and deletion)	3
7.	Write a C program for traversing a directed graph through Depth First Search	6
8.	Write a C program for traversing a directed graph through Breadth First Search	3
9.	Write a C program to implement the N queens' problem	6
10.	Write a C program to implement Dijkstra algorithm	6
	Total Hours	**45**

COURSE OUTCOME

CO1: Perform basic operations on the stack and queue such as push, pop, enqueue, and dequeue and validate the correctness and efficiency of the array implementation for both data structures.

CO2 : Demonstrate proficiency in implementing and managing fundamental data structures for efficient storage and retrieval of information.

CO3 : Apply efficient sorting and searching algorithms to process and organize data, enhancing overall algorithmic efficiency.

CO4: Gain insights of various traversal algorithms for graphs (DFS and BFS) and implement the underlying operations and mechanisms of these data structures.

CO5 : Develop applications using various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Perform basic operations on the stack and queue such as push, pop, enqueue, and dequeue and validate the correctness and efficiency of the array implementation for both data structures.	3	3	3	-	3	-	1	-	1	-	-	-
CO2	Demonstrate proficiency in implementing and managing fundamental data structures for efficient storage and retrieval of information.	3	3	3	1	3	-	3	-	-	-	-	-
CO3	Apply efficient sorting and searching algorithms to process and organize data, enhancing overall algorithmic efficiency.	3	3	3	1	2	-	2	-	-	-	-	-
CO4	Gain insights of various traversal algorithms for graphs (DFS and BFS) and implement the underlying operations and mechanisms of these data structures.	3	3	3	2	2	-	2	-	-	-	-	-
CO5	Develop applications using various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.	3	3	2	3	2	-	2	-	1	-	-	-
	CO PO Mapping Average Value	**3.0**	**3.0**	**2.8**	**1.8**	**2.4**	**-**	**2.0**	**-**	**1.0**	**-**	**-**	**-**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2801	INTERNSHIP / INDUSTRIAL TRAINING	0	0	3	1.5

COURSE OBJECTIVE

1. Apply theoretical concepts in real-world industry settings, demonstrating a clear understanding of practical applications.
2. Acquire and enhance both technical and soft skills, demonstrating adaptability in dynamic work environments.
3. Gain exposure to professional work culture, understanding and adhering to workplace ethics and norms.
4. Project Management and Independence in decision making.
5. Build professional networks, enhancing employability, and gaining valuable career insights.

Pre-requisite - Nil

Sl. No.	Description of the Experiments
1.	Students should submit a report on the Training / Internship Undergone and a certificate from the concerned organization
2.	Presentation about the training experience gained should be presented in front of panel members.
3.	Assess the duration of the Industrial Training based on industry standards and the depth of exposure gained.

Total Practical Hours 45

COURSE OUTCOME

CO1: Apply theoretical knowledge by translating classroom concepts into practical applications, demonstrating a clear understanding of real-world scenarios.
CO2 Develop and refine technical and soft skills while showcasing adaptability in dynamic work environments.
CO3 :Experience professional work culture while grasping and adhering to workplace ethics and norms.
CO4 : Engage in project management by participating in or leading projects, showcasing independence in decision-making.
CO5 : Establish professional networks to augment employability and acquire valuable career insights.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply theoretical knowledge by translating classroom concepts into practical applications, demonstrating a clear understanding of real-world scenarios.	3	3	3	2	3	-	3	2	2	1	2	3
CO2	Develop and refine technical and soft skills while showcasing adaptability in dynamic work environments.	3	3	3	1	3	-	3	1	2	2	3	3
CO3	Experience professional work culture while grasping and adhering to workplace ethics and norms.	3	3	1	-	2	3	3	2	1	1	3	3
CO4	Engage in project management by participating in or leading projects, showcasing independence in decision-making.	3	3	2	-	3	-	3	3	3	3	2	3
CO5	Establish professional networks to augment employability and acquire valuable career insights.	2	2	1	-	2	-	3	-	-	3	1	3
	CO PO Mapping Average Value	**2.80**	**2.80**	**2.00**	**1.50**	**2.60**	**3.00**	**3.00**	**2.00**	**2.00**	**2.00**	**2.20**	**3.00**

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SEMESTER –III

Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3203R	WEB DEVELOPMENT	3	1	0	4

COURSE OBJECTIVE

1. Analyze the foundational elements of J2EE platform, including its architecture, enterprise styles and the working principles Servlets.
2. Analyze the core components and concepts of JavaServer Pages (JSP), including its introduction, life cycle, architecture, and the use of scripting elements
3. Learn the fundamentals of the Spring framework, with a focus on the Model-View-Controller pattern
4. Explore React JS, including its components, state management, and application development.
5. Explore Node.js for server-side JavaScript development and its various modules.

Pre – requisite – 21CA1201 UI Design and Development

Unit	Description	Instructional Hours
I	**J2EE PLATFORM** Introduction -Enterprise Architecture Styles -J2EE Architecture - Containers - J2EE Technologies: Servlet, JSP, ETB and Types, JDBC,JMS,JTA, Java Mail, JNDI and JCA. **SERVLETS** Overview – architecture – life cycle – Interface – Generic Servlet – Http Servlet - filter – session – cookies – hidden form field – URL Rewriting – Http Session – Session login and logout.	12
II	**JSP** Introduction – life cycle – architecture – Scripting elements: scriptlet tag – expression tag – declaration tag- objects – Directive elements: page directive – include directive – tag lib directive – Custom Tag.	12
III	**SPRING** Framework - Modules - Spring in IDE - MVC: web MVC - flow of MVC - multiple view page - multiple controller - Tag library - text field - Radio button - check box - drop down list - CURD application - File Upload - Pagination using MySQL	12
IV	**REACT JS** Introduction – installation – creating react application – JSX – components – state – props – constructors – forms – events – list – keys – refs – frags – router – CSS – animations – bootstrap – map – table – flux – higher order components.	12
V	**NODE.JS** Introduction – installation – console – REPL – Package Manager – Command Line Options – Global Objects – Timer – Error handling – DNS – Callbacks – Events – Web Module – Node.js MySQL – Node.js Mongo DB	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Designing and implementing dynamic web applications using Servlets
CO2: Develop dynamic web pages using JSP.
CO3: Develop skills in building web applications using Spring MVC, including handling form submissions, file uploads, and pagination.
CO4: Create interactive and dynamic user interfaces using React.
CO5: Create Server side scripting using Node JS and perform database connectivity operations.

REFERNCES:

R1: Iuliana Cosmina , Rob Harrop ,Chris Schaefer ,Clarence Ho "Pro Spring 5 -An In-Depth Guide to the Spring-Frame work and Its Tools "-Fifth Edition –APRESS,2017
R2: Craig Walls, "Spring in Action, 4th Edition Kindle Edition, Manning Publication, 2015.
R3:JobineshPurushothaman, "RESTful Java Web Services" Second Edition, Packt Publishing, 2015
R4: Robin Wieruch -The Road to React "Your journey to master plain yet pragmatic React",2016
R5: Cory Gackenheimer "Introduction to React"-Published by Apress-2015

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Designing and implementing dynamic web applications using Servlets	3	3	3	3	3	1	3	2	-	1	1	2
CO2	Develop dynamic web pages using JSP.	3	2	3	3	2	1	3	2	-	1	1	1
CO3	Develop skills in building web applications using Spring MVC, including handling form submissions, file uploads, and pagination.	3	3	3	3	2	1	3	2	-	1	1	1
CO4	Create interactive and dynamic user interfaces using React.	3	3	3	3	2	1	3	2	1	1	1	1
CO5	Create Server side scripting using Node JS and perform database connectivity operations.	3	3	3	3	2	2	3	2	1	1	1	1
	CO PO Mapping Average Value	**3.0**	**2.8**	**3.0**	**3.0**	**2.2**	**1.2**	**3.0**	**2.0**	**1.0**	**1.0**	**1.0**	**1.2**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3205	CRYPTOGRAPHY AND NETWORK SECURITY	3	1	2	4

COURSE OBJECTIVE

1. Analyze the network security fundamentals, including legal aspects, ethical considerations, and the OSI security architecture.
2. Evaluate the principles of symmetric encryption, including algorithms, block modes, and key distribution.
3. Explore authentication mechanisms, including Kerberos, x.509, and public-key cryptography.
4. Analyze the fundamentals of IP security overview, architecture, mechanisms, and web security principles.
5. Explore intruders, intrusion detection, password management, malicious software, and firewall design.

Pre-requisite – 21CA1202 Computer Networks

Unit	Description	Instructional Hours
I	**INTRODUCTION** Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture–Classical encryption techniques: substitution techniques, transposition techniques, steganography-Foundations of modern cryptography: perfect security–information theory–product cryptosystem–cryptanalysis.	12
II	**SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY** Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.	12
III	**AUTHENTICATION APPLICATIONS** Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.	12
IV	**IP Security** IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.	12
V	**INTRUDERS** Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Develop awareness of security trends, classical encryption techniques, and the foundations of modern cryptography.
CO2: Gain proficiency in implementing symmetric encryption, understanding stream ciphers, RC4, and different block modes.
CO3: Acquire skills in implementing Kerberos, x.509, and understanding public-key cryptography for secure communication.
CO4: Gain proficiency in implementing IP security, understanding web security, and network management security concepts.
CO5: Acquire skills in detecting and preventing intrusions, understanding password management, and implementing effective firewall designs.

REFERENCE BOOKS:

R1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
R2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
R3. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007
R4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

R5. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.
R6. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.
R7. William Stallings, "Network Security Essentials Applications and Standards", Third Edition, Pearson Education, 2008.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop awareness of security trends, classical encryption techniques, and the foundations of modern cryptography.	3	3	3	1	2	2	1	1	1	1	1	1
CO2	Gain proficiency in implementing symmetric encryption, understanding stream ciphers, RC4, and different block modes.	3	2	3	1	2	2	1	1	1	1	-	1
CO3	Acquire skills in implementing Kerberos, x.509, and understanding public-key cryptography for secure communication.	3	3	3	1	2	2	1	-	2	2	1	1
CO4	Gain proficiency in implementing IP security, understanding web security, and network management security concepts.	3	3	3	1	1	2	1	-	2	2	1	-
CO5	Acquire skills in detecting and preventing intrusions, understanding password management, and implementing effective firewall designs.	3	3	3	1	1	2	1	-	1	1	1	-
	CO PO Mapping Average Value	**3.0**	**2.8**	**3.0**	**1.0**	**1.6**	**2.0**	**1.0**	**1.0**	**1.4**	**1.4**	**1.0**	**1.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3251	DATA SCIENCE AND ANALYTICS	3	0	2	4

COURSE OBJECTIVE

1. Differentiate between Data Science and Analytics, comprehend their life cycles, and apply statistical methods to analyze the Diabetes dataset, showcasing a practical understanding of data analysis concepts.
2. Explore data analysis knowledge domains, understanding structured and unstructured data, and performing exploratory data analysis (EDA).
3. Apply ML concepts in a case study covering both supervised and unsupervised learning scenarios.
4. To Gain knowledge on various data modeling Techniques.
5. To Learn the basic and Advanced Features of Open Source Big Data Tools and Frameworks

Pre-requisite – 21MA1101 Probability and Statistics, Operation Research

Unit	Description	Instructional Hours
I	**Introduction to Data science & Analytics** Introduction – Difference Between Data science and Analytics – Life Cycle of Data Science and Data Analytics. Statistics and Probability Types of Data –Mean, Media Mode – Standard Deviation, Variance – Probability Density and Probability Mass Functions – Percentiles and Moments	8
	Illustrative problems: Use the Diabetes data set from UCI repository and perform the Univariate Analysis : Frequency, Mean, Median, Mode, Variance , Standard Deviation Illustrate Problem for Moments and Percentiles	4
II	**Introduction to Data Understanding and EDA** Knowledge domains of Data Analysis, Structures and Unstructured Data , Data Set Generation, Importing data set from various sources and exporting to various other formats – Data Types – Insights from Datasets –Feature Engineering — Data Wrangling - Missing data values	6
	Illustrative Problems *Use the income dataset was extracted from 1994 U.S. Census database and perform Data Fetching, Data Cleaning, Feature Engineering, Exploratory data Analysis*	6
III	**Machine Learning** Machine Learning – Types of ML – Unsupervised Algorithms – Dimensionality Reduction , Clustering – Supervised Algorithms – Classification , Regression	6
	Case Study onSupervised Learning, Un Supervised Learning	6
IV	**Data Modeling** Bayesian Modeling –Support Vector Methods –Kernel Methods – Principal Component Analysis – NoSQL Introduction – RDBMS vs MongoDB – Mongo DB Database Model – Data Modeling in Hbase – Defining Schema CRUD Operations	6
	Apply Bayesian and SVM techniques on Diabetes Data Set *Case Study on Data Distribution in HBase and MongoDB*	6
V	**Data Analytical Frameworks** Introduction to Hadoop – Hadoop Overview – RDBMS Vs Hadoop – HDFS- Components and Block Replication – Introduction to Map Reduce –Running Algorithms using Map Reduce – Introduction to HBase – Architecture, HLog and HFile.	6
	Implement a Map reduce program for a weather Data set *Find Average, max, min temperature for each year in National Climate data centre data set* *Filter the readings of a set based on value of the measurement. The program must save the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.* *HBase Installation and Operations on HBase*	6
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Apply statistical measures, and analyze real-world data using the Diabetes dataset, showcasing proficiency in Data Science and Analytics.

CO2 :Develop applications by applying exploratory data Analysis with the modern tools.

CO3: Apply machine learning algorithms on case studies, demonstrating proficiency in supervised and unsupervised learning techniques.

CO4: Apply Bayesian and SVM techniques on the Diabetes dataset, explore data distribution in HBase and MongoDB, and understand CRUD operations.

CO5: Implementation of HDFS architecture and create of application using Map reduce framework, Hbase Installations and Operations.

R1. Frank Pane, "Hands On Data Science and Python Machine Learning", Packt Publishers, 2017.

R2. Bharti Motwani, "Data Analytics using Python", Wiley Publishing 2020.

R3. Jesus Rogel-Salazar , "Advanced Data Science and Analytics with Python", CRC Press, 2020.

R4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John wiley& Sons 2012.

R5. Nishant Garg , "HBase Essentials", Packt 2014.

R6. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly 2013.

R7. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly 2013.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply statistical measures, and analyze real-world data using the Diabetes dataset, showcasing proficiency in Data Science and Analytics.	3	3	3	3	3	2	3	-	1	2	1	2
CO2	Develop applications by applying exploratory data Analysis with the modern tools.	3	2	3	2	3	2	3	-	1	2	1	2
CO3	Apply machine learning algorithms on case studies, demonstrating proficiency in supervised and unsupervised learning techniques.	3	3	3	2	3	2	3	-	1	2	1	2
CO4	Apply Bayesian and SVM techniques on the Diabetes dataset, explore data distribution in HBase and MongoDB, and understand CRUD operations.	3	3	3	2	3	2	2	-	1	2	1	2
CO5	Implementation of HDFS architecture and create of application using Map reduce framework, Hbase Installations and Operations.	3	3	3	2	2	2	3	-	1	2	1	2
	CO PO Mapping Average Value	**3.0**	**2.8**	**3.0**	**2.2**	**2.8**	**2.0**	**2.8**	**-**	**1.0**	**2.0**	**1.0**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21EC3251	INTERNET OF THINGS	2	0	2	3

Course Objective

1. To understand the fundamentals of Internet of Things.
2. To understand the IoT design methods and their Concepts
3. To build a small low-cost embedded system using Galileo/Arduino or equivalent boards.
4. To understand the concept of advanced high power Raspberry Pi board.
5. To get an idea where the application areas are available for the Internet of Things.

Pre-requisite – 21EC2231 Embedded System and Sensors

Unit	Description	Instructional hours
I	**Introduction to IoT** Introduction – Physical and Logical design of IoT – IoT Enabling Technologies – IoT levels and deployment templates.	6
II	**IoT Design Methodology** IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.	6
III	**Building IoT with Galileo/Arduino** Introduction to Intel Galileo Gen2/Arduino- Interfaces - Arduino IDE – Programming	6
IV	**Getting Started with Raspberry Pi** About the Board – Linux on Raspberry Pi - Interfaces - Programming Raspberry Pi with python – Examples.	6
V	**Application Development** Home Automation – Cities – Environment: Weather monitoring system – Forest Fire detection – Agriculture – Productivity Applications.	6
	Practicals 1. Introduction to Intel Galileo Gen2/Arduino Uno and LED Interfacing 2. Sensor Interfacing with Intel Galileo Gen2/Arduino Uno 3. Raspberry Pi - Introduction and installation of OS 4. Home automation using Pi 5. Using Node-RED Visual Editor on Rpi 6. IoT Applications based on Pi 7. Mini Project	15
	Total Instructional hours	**45**

Course Outcome

CO1: Describe IoT with various tools.
CO2: Design IoT using various methodologies
CO3: Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
CO4: Deploy an IoT application and connect to the cloud using Raspberry Pi.
CO5: Analyze applications of IoT in real time scenario

TEXT BOOKS:

T1- ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
T2- Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.

REFERENCES:

R1- Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine - to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
R2- Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
R3 - Raspberry Pi cookbook: Software and hardware problems and solutions, Monk, Simon. O'Reilly Media, Inc., 2016.
R4- The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Describe IoT with various tools.	3	3	3	3	2	2	2	1	1	1	-	2
CO2	Design IoT using various methodologies	3	2	3	2	2	2	2	1	-	1	-	1
CO3	Design a portable IoT using Arduino/ equivalent boards and relevant protocols.	3	3	3	2	2	2	2	1	-	1	-	-
CO4	Deploy an IoT application and connect to the cloud using Raspberry Pi.	3	3	3	2	2	2	2	1	1	1	-	-
CO5	Analyze applications of IoT in real time scenario	3	3	3	2	2	2	2	1	1	1	-	1
	CO PO Mapping Average Value	**3.0**	**2.8**	**3.0**	**2.2**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**	**1.0**	**-**	**1.3**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3001	MINI PROJECT	0	0	3	1.5

COURSE OBJECTIVE

1. Equip students with practical problem-solving skills.
2. Familiarize students with software lifecycle models and relevant artifacts.
3. Foster creativity and innovation through the development of unique projects.
4. Enhance skills in report writing, presentation, and demonstration.
5. Encourage user-based testing and gather valuable feedback from the project's benefiting society.

Pre-requisite – NIL

Sl. No.	Description of the Experiments
1.	Students shall develop creative or innovative project.
2.	Need to submit a report, presentation with demo.
3.	User Based Testing and feedback from the benefited society required.

Total Practical Hours 45

COURSE OUTCOME

CO1: Develop skill to create practical solutions to identified problem.
CO2: Use software lifecycle model and other artifacts appropriate for problem.
CO3: Identify and master tools required for the project implementation.
CO4: Plan and work systematically towards completion of a project work.
CO5: Develop the ability to explain and defend their work in front of an evaluation panel.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop skill to create practical solutions to identified problem.	3	3	3	1	2	1	1	3	1	-	1	1
CO2	Use software lifecycle model and other artifacts appropriate for problem.	3	3	2	1	1	1	1	-	2	-	1	1
CO3	Identify and master tools required for the project implementation.	3	3	2	1	2	1	1	-	3	-	1	1
CO4	Plan and work systematically towards completion of a project work.	3	3	3	1	1	1	1	2	3	1	2	1
CO5	Develop the ability to explain and defend their work in front of an evaluation panel.	3	3	3	1	2	-	-	-	3	-	3	2
	CO PO Mapping Average Value	**3.0**	**3.0**	**2.6**	**1.0**	**1.6**	**1.0**	**1.0**	**2.5**	**2.4**	**1.0**	**1.6**	**1.2**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3002R	WEB DEVELOPMENT LAB	0	0	3	1.5

COURSE OBJECTIVE

1. Develop a secure login page in Servlet.
2. Develop a registration form using JSP to capture user details and employ custom tags to generate Indian Standard date and time.
3. Implement a railway reservation form and a basic CRUD application using the Model-View-Controller (MVC) architecture in Java.
4. Implement dynamic animations in a React application
5. Develop a Node.js application that integrates with MySQLand Mongo DB to perform fundamental database operations.

Pre-requisite – 21CA1201 UI Design and Development

S.No.	Description of the Experiments	Practical Hours
1	Create a login page and check password using cookies in Servlet	6
2	Using JSP create a registration form to get details like name, password, email id, gender, country and display the details.	6
3	Generate Indian Standard date and time using Custom Tags	3
4	Create a railway reservation form using MVC	3
5	Develop a simple CRUD application using Spring MVC	6
6	In the App.js file, import react-transition-group component, and create the CSS Transition component that uses as a wrapper of the component you want to animate. Use transition Enter Timeout and transition Leave Timeout for CSS Transition when you insert or delete elements from the list.	3
7	Write a program to change the text font, size and colour using inline styles	3
8	Create a text file and synchronize the text content using node.js	3
9	Create a table for employee details and perform actions like insert, update, select and delete options using Node.js and MySQL	6
10	Create a table for student details and perform actions like insert, select, query, sort and remove options using MongoDB	6
Total Instructional hours		**45**

Course Outcome

CO1: To create a functional login page using Servlet and password validation through cookies.
CO2: Create a dynamic user registration form using JSP and implement the integration of JSP features for effective web form development.
CO3: Design and implement a user-friendly railway reservation by applying the principles of MVC to web application development
CO4: Establish a connection between a Node.js application and a MySQL database.
CO5: Establish a connection between a Node.js application and a MongoDB database

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To create a functional login page using Servlet and password validation through cookies.	3	3	3	1	3	2	2	1	1	2	3	2
CO2	Create a dynamic user registration form using JSP and implement the integration of JSP features for effective web form development.	3	2	2	2	3	1	1	2	2	2	3	3
CO3	Design and implement a user-friendly railway reservation by applying the principles of MVC to web application development	3	3	2	2	3	1	-	2	2	1	3	2
CO4	Establish a connection between a Node.js application and a MySQL database.	3	3	3	2	3	1	2	2	2	2	3	2
CO5	Establish a connection between a Node.js application and a MongoDB database	3	1	2	3	3	1	-	1	2	2	3	3
	CO PO Mapping Average Value	**3.0**	**2.4**	**2.4**	**2.0**	**3.0**	**1.2**	**1.7**	**1.6**	**1.8**	**1.8**	**3.0**	**2.4**

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3201	BIG DATA ANALYTICS	3	1	0	4

COURSE OBJECTIVE

1. Develop an understanding on the fundamental concepts of big data and analytics
2. To explore tools and practices for working with big data
3. To learn about stream computing.
4. To Understand big data analytics and data visualization techniques
5. To understand NoSQL big data management

Unit	Description	Instructional Hours
I	**OVERVIEW OF BIG DATA** Introduction to Big Data Platform –Challenges of Conventional Systems -Intelligent data analysis – Nature of Data-Analytic Processes and Tools -Analysis vs Reporting -Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions -Re-Sampling - Statistical Inference	12
II	**TECHNOLOGIES FOR HANDLING BIG DATA** Understanding Hadoop Ecosystem- framework of MapReduce and uses of MapReduce-Hadoop YARN Architecture- Exploring Hive- Exploring Pig-Exploring Oozie	12
III	**DATA STREAMS USING SPARK 2.0** Mathematical Formulation of LPP- Graphical method– Simplex method – Artificial variable Techniques- Sensitivity analysis.	12
IV	**DATA VISUALIZATION** History of Visualization, Goals of Visualization, Types of Data Visualization: Scientific Visualization, Information Visualization, Visual Analytics, Impact of visualization - Data Visualization with Tableau - Social Media Analytics and Text Mining.	12
V	**NoSQL DATA MANAGEMENT** Document databases, relationships, graph databases, schema less databases, CAP Theorem	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Understand the fundamental concepts of big data and analytics
CO2: Able to explore tools and practices for working with big data
CO3: Able to learn about stream computing.
CO4: Understand big data analytics and data visualization techniques
CO5: Understand NoSQL big data management

REFERENCE BOOKS:

R1. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly Media, 2012.
R2. Paul Zikopoulos, Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, Indian Edition, 2017.
R3. Bill Franks," Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley &Sons, 2012.
R4. Zikopoulos, Paul & Chris Eaton, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", Tata McGraw Hill Publications, 2011.
R5. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014
R6. Paul Zikopoulos, DirkdeRoos , Krishnan Parasuraman ,Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3202	OPERATING SYSTEMS	3	1	0	4

COURSE OBJECTIVE

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To Describe the concepts of process synchronization, threads and deadlocks
3. To describe the concepts of Memory management with respect to Physical and Virtual Memory
4. To describe File Management, I/O Devices and various Disk Scheduling Strategies
5. To Understand the concepts of Virtualization and develop a case study application on UNIX OS

Unit	Description	Instructional hours
I	**OS INTRODUCTION AND PROCESS MANAGEMENT AND SCHEDULING ALGORITHMS** **Introduction:** Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, System Calls, Operating System Structure **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Process Scheduling:** Basic concepts of scheduling, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. **Scheduling algorithms:** Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling	12
II	**PROCESS SYNCHRONIZATION, THREADS AND DEADLOCKS** **Inter-process Communication:** Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem **Concurrent Programming:** Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery. **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	12
III	**MEMORY MANAGEMENT** **Memory Management:** Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	12
IV	**FILE SYSTEMS MANAGEMENT, I/O AND DISK MANAGEMENT** **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **I/O Hardware:** I/O devices, Device controllers, Direct Memory Access, Principles of I/O. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	12
V	**VIRTUAL MACHINES AND CASE STUDY** History, Benefits and Features, Building Blocks – Types of Virtual Machines – Virtualization and Operating System Components – VMware **Case study:** UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.	12

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Total Instructional hours **60**

COURSE OUTCOME

CO1: Describe the various OS functionalities, structures Process Management and Scheduling Algorithms
CO2: Apply and explore the communication between inter process and synchronization techniques.
CO3: Implement memory placement strategies, replacement algorithms related to main and virtual memory techniques.
CO4: Differentiate the file systems for applying various file allocation and access techniques, I/O and Disk Scheduling Strategies
CO5: Representing virtualization concepts and designing of OS with a Case Study.

REFERENCES BOOKS:

R1. Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley, 10th Edition, 2019.
R2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
R3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces,Arpaci-Dusseau Books, Inc (2015).
R4. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
R5. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes. Operating systems. Delhi. Pearson Education: Dorling Kindersley, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3203	WEB DEVELOPMENT	3	1	0	4

COURSE OBJECTIVE

CO1: To enable the creation of dynamic, platform-independent method for building web-based applications using Html and JSP
CO2: To understand and provide Rapid Application Development feature to the Spring framework.
CO3: To learn the basics of micro services and micro services architectures.
CO4: To understand JavaScript library for building user interfaces.
CO5: To understand how to interact with the web page.

Unit	Description	I9nstructional Hours
I	**J2EE PLATFORM** Introduction - J2EE Architecture – Containers- J2EE Standard Services – J2EE Technologies-Using JNDIJNDI Naming Context- Java and LDAP - LDAP operations – LDAP Information Model-LDAP Naming Model.	12
II	**JSP** Basics of HTML, Introduction to JSP - Life cycle- Implicit objects & scopes- Directives- Scripting elements- Actions- JSTL & Tag library.	12
III	**MICRO SERVICES IN SPRING BOOT** Micro Services- Design Considerations- Cloud- Cloud Config- Netflix- Fault Tolerance Concepts- API Gateway- Messaging Queue Concepts- Oatuh2 Concepts- Swagger API- Cloud Hosting.	12
IV	**REACT JS BASICS** Environment setup- JSX- Components- State- Props overview & validation- Component API & Lifecycle.	12
V	**REACT JS ADVANCED** Forms- Events- Refs- keys- Router- Flux concept- Using flux- Animations- Higher order components	12
	Total Instructional Hours	**60**

COURSE OUTCOME

CO1: Able to understand the collection of useful J2EE Platform and JSP tags which encapsulates the core functionality common to many JSP applications.
CO2: Able to develop stand-alone and production ready spring applications.
CO3: Able to develop the concept of micro services and understand how to create great micro services with Spring Boot and Spring Cloud.
CO4: Able to to create reusable UI components in React JS
CO5: Able to handle the data when it changes value or gets submitted.

REFERNCES:

R1. Craig Walls, "Spring in Action, 4th Edition Kindle Edition, Manning Publication, 2015.
R2. JobineshPurushothaman, "RESTful Java Web Services" Second Edition, Packt Publishing, 2015
R3. James Holmes "Struts: The Complete Reference, "2nd Edition, McGraw Hill, 2007.
R4. SubrahmanyamAllamaraju and Cedric Buest , "Professional Java Server Programming (J2EE 1.3 Edition)", Shroff Publishers & Distributors Pvt Ltd.
R5. TonyDahbura, Rob Weltman "LDAP Programming with Java", Addison-Wesley Professional, 2000.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3204	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE OBJECTIVE

1. To understand the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents
2. To Understand various machine learning algorithms used in Artificial Intelligence.
3. To Understand the fundamental concepts of NLP.
4. To Acquire the fundamental knowledge of Neural Networks.
5. To understand and learn about Reinforcement Learning and its features

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE** What is Artificial Intelligence - The History of Artificial Intelligence - Goals of Artificial Intelligence - Artificial Intelligence Techniques - Applications of Artificial Intelligence - What contributes to Artificial Intelligence - Real life Use cases in various industries **INTELLIGENT AGENTS AND ENVIRONMENTS** Agents and Environments - Agents Terminology - The Structure of Intelligent Agents - The Nature of environments - Properties of Environment - The concept of Rationality - What is ideal Rational Agent	9
II	**MACHINE LEARNING** Linear Regression -Logistic Regression- Naive Bayes -Model Selection Advanced Regression- Support Vector Machine (Optional)- Tree Models- Model Selection –Boosting algorithms -Unsupervised Learning- Clustering - Principal Component Analysis.	9
III	**NATURAL LANGUAGE PROCESSING** Lexical Processing- Syntactic Processing- Semantic Processing - Building Chatbots with Rasa.	9
IV	**DEEP LEARNING** Introduction to Neural Networks- Syntactic Processing -Neural Networks–Assignment-Convolutional Neural Networks –Industry Applications- Recurrent Neural Networks-Neural Networks Project-Gesture Recognition.	9
V	**REINFORCEMENT LEARNING** Classical Reinforcement Learning– Elements of Reinforcement Learning- Features of Reinforcement Learning- Types of Reinforcement learning- Reinforcement Learning Algorithms	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Acquire the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents
CO2: Able to Understand various machine learning algorithms used in Artificial Intelligence.
CO3: knowledge of fundamental concepts of NLP
CO4: Acquired the fundamental knowledge of Neural Networks
CO5: Able to understand the Reinforcement Learning and its features.

REFERENCE BOOKS:

R1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2016.
R2.I. Bratko, Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
R3. Gerhard Weiss, Multi Agent Systems, Second Edition, MIT Press, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3001	MINI PROJECT LAB	0	0	3	1.5

Sl. No.	Description of the Experiments
1.	Students shall develop creative or innovative project.
2.	Need to submit a report, presentation with demo.
3.	User Based Testing and feedback from the benefited society required.

Total Practical Hours **45**

COURSE OUTCOME

CO1: Develop skill to create practical solutions to identified problem.
CO2: Use software lifecycle model and other artifacts appropriate for problem.
CO3: Identify and master tools required for the project.
CO4: Plan and work systematically towards completion of a project work.
CO5: Develop the ability to explain and defend their work in front of an evaluation panel.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3002	WEB DEVELOPMENT LAB	0	0	3	1.5

COURSE OBJECTIVE

CO1: To know about the spring frame work.
CO2: To develop conceptual understanding of database management system
CO3: To understand the real-world applications by using spring technology
CO4: To design and understanding the ReactJS concepts
CO5: To understand the concepts of data transfer via routes

S.no	Description of the experiments	practical hours
1	Design a simple web service using Spring boot application getting the student information from the Client side and retrieve the information from sever side.	6
2	Design a simple spring MVC application that take user input and checks the input using standard validation annotations.	6
3	Develop a simple spring application using spring boot and spring boot RESTful web services.	6
4	Develop an application using spring frame work, light weight containers and dependency injection with spring.	6
5	Design a Calculator with ReactJS that can perform the essential functions of basic mathematical functions.	6
6	Design a Form Validation in ReactJSwith React Functional Components	5
7	Design a Registration form in ReactJS using routes and data transfer via routes	5
8	Create a student *table dynamically from* any JSON *usingReactJS*	5
	Total Instructional hours	**45**

COURSE OUTCOME

CO1: Able to understand the client and server technologies by using spring concepts
CO2: Ability to know about the spring applications and Restful Web services
CO3: Ability to understand the dependencies by using spring boot applications
CO4: Ability to know about the use of react components
CO5: Ability to know about the uses of json data in ReactJS

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PROFESSIONAL ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3301	BLOCK CHAIN	3	0	0	3

COURSE OBJECTIVE

1. To understand the technology components of Block chain and its works behind the scenes.
2. To understand the Bitcoin and its limitations by comparing with other alternative coins.
3. To establish deep understanding of the Ethereum model, its consensus model and code execution.
4. To understand the architectural components of a Hyper ledger and its development framework.
5. To be aware of the alternative blockchains and emerging trends in blockchain

Unit	Description	Instructional Hours
I	**INTRODUCTIONTOBLOCKCHAIN** History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain –Blockchain and Full Ecosystem Decentralization–Platforms for Decentralization.	9
II	**INTRODUCTIONTOCRYPTOCURRENCY** Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments –Wallets–AlternativeCoins–TheoreticalLimitations–Bitcoinlimitations–Namecoin–Primecoin –Zcash–Smart Contracts–Ricardian Contracts.	9
III	**ETHEREUM** The Ethereum Network–Components of Ethereum Ecosystem–Ethereum Programming Languages: Runtime By teCode, Blocks and Blockchain, Fee Schedule–Supporting Protocols–Solidity Language	9
IV	**WEB3andHYPERLEDGER** Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as Protocol–The Reference Architecture–Hyperledger Fabric–Distributed Ledger–Corda.	10
V	**ALTERNATIVEBLOCKCHAINSANDNEXTEMERGINGTRENDS** Kadena–Ripple–Rootstock–Quorum–Tendermint–Scalability–Privacy–OtherChallenges–BlockchainResearch– Notable Projects –Miscellaneous Tools	8
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Understand the technology components of Blockchain and how it works behind the scenes.
CO2: Understand the Bitcoin and its limitations by comparing with other alternative coins.
CO3: Establish deep understanding of the Ethereum model, its consensus model and code execution.
CO4: Understand the architectural components of a Hyperledger and its development framework.
CO5:Aware of the alternative blockchains and emerging trends in blockchain.

REFERENCE BOOKS:

R1. Imran Bashir,"Mastering Blockchain:Distributed Ledger Technology, Decentralization and Smart Contracts Explained",2nd ,Edition, PacktPublishing,2018.
R2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-on Approach", VPTPublisher,2017.
R3. Andreas Antonopoulos, Satoshi Nakamoto,"MasteringBitcoin",O'Reilly,2014.
R4. Roger Wattenhofer,"The Science of the Blockchain," CreateSpace IndependentPublishing,2016.
R5. A.Narayanan, J.Bonneau,E.Felten,A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
R6. Alex Leverington, "Ethereum Programming", PacktPublishing,2017.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3302	CLOUD COMPUTING	3	0	0	3

COURSE OBJECTIVE

1. To understand an insight into cloud computing
2. To understand the fundamentals concepts of cloud.
3. To understand architectures and anatomy of cloud.
4. To understand various models of cloud.
5. To understand the significant cloud service providers

Unit	Description	Instructional Hours
I	**COMPUTING PARADIGMS** High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.	9
II	**CLOUD COMPUTING FUNDAMENTALS** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models	9
III	**CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration	9
IV	**CLOUD SERVICE MODELS** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.	9
V	**CLOUD SERVICE PROVIDERS** EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Ability to understand various service delivery models of a cloud computing architecture.
CO2: Ability to understand the ways in which the cloud can be programmed and deployed.
CO3: Ability to understand cloud architecture, cloud anatomy, network connectivity in cloud, cloud management.
CO4: Ability to understand Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) with several other service models
CO5: Ability to understand major service providers known in the cloud arena and discusses in detail about the services they offer.

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and AndrzejM. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, GeofferyC.Fox, Jack J.Dongarra, Elsevier,2012.

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3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3303	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

COURSE OBJECTIVE

1. To understand Cryptography Theories, Algorithms and Systems.
2. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
3. Understand the fundamental principles of access control models and techniques, Have a strong understanding of different cryptographic protocols and techniques
4. Authentication and secure system design and apply methods for authentication, access control, intrusion detection and be able to use them.
5. Identify and mitigate software security vulnerabilities in existing systems prevention.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis	9
II	**SYMMETRIC KEY CRYPTOGRAPHY** Mathematics Of Symmetric Key Cryptography: Algebraic structures - Modular arithmetic-Euclid"s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.	9
III	**PUBLIC KEY CRYPTOGRAPHY** MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	9
IV	**MESSAGE AUTHENTICATION AND INTEGRITY** Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509	9
V	**SECURITY PRACTICE AND SYSTEM SECURITY** Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3: Apply the different cryptographic operations of public key cryptography
CO4: Apply the various Authentication schemes to simulate different applications.
CO5: Understand various Security practices and System security standards.

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REFERENCES BOOKS:

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
3. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007
4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3304	DEEP LEARNING	3	0	0	3

COURSE OBJECTIVE

1. To understand the basic ideas and principles of neural networks.
2. To understand the basic concepts of deep learning.
3. To familiarize with image processing facilities like TensorFlow and Keras.
4. To appreciate the use of deep learning applications.
5. To understand and implement deep learning architectures.

Unit	Description	Instructional Hours
I	**BASICS OF NEURAL NETWORKS** Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Back propagation Networks.	9
II	**INTRODUCTION TO DEEP LEARNING** Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other Differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training –Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversial Training – Optimization for Training Deep Models.	9
III	**CONVOLUTIONAL NEURAL NETWORKS** CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks – Applications.	9
IV	**ADDITIONAL DEEP LEARNING ARCHITECTURES** Long Short-Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders – Representation Learning – Deep generative Models – Deep Belief Networks – Deep Generative Networks – Generative Schemes – Evaluating Generative Models.	9
V	**APPLICATIONS OF DEEP LEARNING** Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Understand the role of deep learning in machine learning applications.

CO2: Get familiar with the use of TensorFlow and Keras in deep learning applications.

CO3: Design and implement deep learning applications.

CO4: Critically analyze different deep learning models in image related projects.

CO5: Design and implement convolutional neural networks and know about applications of deep learning in NLP and image processing.

REFERENCE BOOKS:

1. Ian J. Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018
3. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.
4. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
5. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3305	E-COMMERCE	3	0	0	3

COURSE OBJECTIVE

1. Various e-commerce business models;
2. Underlying telecommunication network, hardware, and software technologies;
3. How companies use e-commerce to gain competitive advantages;
4. How to plan and execute e-commerce projects;
5. The competitive strategies of leading e-commerce companies in the world.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Information technology and Business-E-Commerce-EDI-E-Commerce types-E-Commerce and World Wide Web-Internet Connectivity-E-Commerce – case studies leading the Transformation-E-Governance case studies leading the Transformation – - Internet communication protocols-Internet services and Resources-Internet Mail-Internet search-issues of concern-Browsers-HTML Java-Internet 2	9
II	**BULIDING BLOCKS FOR E-COMMERCE** Electronic Data Interchange -. costs and benefits – Components of EDI systems- EDI Implementation issues-Identification and tracking tools-The EAN, EANCOM- riticle numbering-bar coding – EAN location numbering –RFID-Business Process Reengineering-Approaches to BBR-Strategic alignment model-BBR Methodology-Management of change- change management – the change management in the government – the implementation plan	9
III	**CYBER SECURITY** Legal issues – Risks – paper documents vs electronic document-technology for authenticating electronic document-Laws for E-Commerce - Cyber-attack-hacking-firewalls-Intrusion Detection System-Secure Socket layer-authentication and assurance of data integrity-cryptography based solutions-digital signature-the protocols for secured messaging-guidelines for cryptography policy-Virtual Private Network. Cybercrimes and Information technology act 2000- cyber forensics	9
IV	**IT ACT 2000** Trust in the Electronic environment-electronic authentication-paper-vs electronic world-The IT act 2000-cybercrimes under the IT act. Public key infra structure- PKI and Certifying Authorities – Electronic payment systems and internet banking-payment gateway-Internet banking-PayPal- Secure Electronic Transaction protocol-electronic cash- electronic cheque- elements of electronic payments	9
V	**CASE STUDIES** E-Commerce Case Studies- E-Commerce in India- Indiatimes.com-Rediff.com-Bazee.com-Steel Authority of India-Amul- the taste of India	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Comprehend the underlying economic mechanisms and driving forces of E-Commerce;
CO2: Understand the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders;
CO3: Appraise the opportunities and potential to apply and synthesize a variety of E-Commerce concepts and solutions to create business value for organizations, customers, and business partners;
CO4: Formulate E-Commerce strategies that lever firms' core competencies, facilitate organizational transformation, and foster innovation;
CO5: Undertake planning, organizing, and implementing of E-Commerce initiatives to effectively respond to of dynamic market environments.

REFERENCE BOOKS:

1. Jeffrey F.Rayport and Bernard J. Jaworski, "Introduction to ECommerce", 2nd Edition, Tata Mc-Graw Hill Pvt., Ltd., 2003.
2. Greenstein, "Electronic Commerce", Tata Mc-Graw Hill Pvt., Ltd., 2000
3.Kamalesh K. Balaji,Debjani Nag, "E-Commerce", Second Edition, McGraw Hill Education, 2015

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3306	MIXED REALITY	3	0	0	3

COURSE OBJECTIVE

1. To understand the basic concepts of Mixed Reality.
2. To design and develop the Mixed Reality applications in different domains.
3. To Design various models using modelling techniques.
4. To Perform Mixed Reality Programming with tool kits.
5. To Evaluate mixed reality-based applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction to Virtual Reality (VR)–Definition– Three I's of VR–VRVs3DComputer Graphics – Benefits - Components of VR– Introduction to AR – System Structure– Key Technology in AR – 3DVision–Approaches-AlternativeInterfaceParadigms–SpatialAR–InputDevices– 3DPositionTrackers – Performance Parameters – Types of Trackers – Navigation and Manipulation Interfaces –Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display –Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays –Human Auditory System.	9
II	**AR & MRCOMPUTINGARCHITECTURE** Computing Architectures of VR –Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures – Multi-pipeline Synchronization–AR Architecture - 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, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	9
III	**MRMODELING** Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling–TransformationMatrices–ObjectPosition–TransformationInvariants– ObjectHierarchies–ViewingThe3DWorld–PhysicalModeling–CollisionDetection–Surface Deformation–ForceComputation–ForceSmoothingAndMapping–BehaviorModeling– ModelManagement.	9
IV	**MR PROGRAMMING** VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of WorldToolkitandJava3D – GHOST–People Shop–Human Factors in VR–Methodology and Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding – Trajectories through Mixed Reality Performance–Mobile Interface Design–Quantitative Evaluation–Qualitative Evaluation.	9
V	**APPLICATIONS** Medical Applications of MR–Education, Arts and Entertainment–Military Applications–Emerging Applications of MR–MR Applications in Manufacturing–Applications of MR in Robotics– Information Visualization–Wearable Computing–Games	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Discuss the basic concepts of Mixed Reality.
CO2: Design and develop the Mixed Reality applications in different domains.
CO3: Design various models using modelling techniques.
CO4: Perform Mixed Reality Programming with toolkits.
CO5: Evaluate mixed reality-based applications.

REFERENCE BOOKS:

R1. Grigore C.Burdea,PhilipCoiffet,"VirtualRealityTechnology", Second Edition,WileyIndia,2017.

R2. Benford, S., GiannachiG., "PerformingMixedReality", MITPress,2011.

R3. CharlesPalmer,JohnWilliamson, "VirtualRealityBlueprints:CreateCompellingVRExperiencesforMobile", Packt Publisher, 2018.

R4. JasonJerald, "TheVRBook: Human-CenteredDesignforVirtualReality" Association forComputing Machinery and Morgan, ClaypoolPublishers,2015

R5. William R. Sherman, Alan B.Craig: Understanding Virtual Reality – Interface, Application,Design",Morgan Kaufmann, 2003

R6.KellyS.Hale,KayM.StanneyHandbookofVirtualEnvironments:Design,Implementation,andApplications,SecondEdition,CRCpress,2014

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3307	ORGANIZATIONAL BEHAVIOR	3	0	0	3

COURSE OBJECTIVE

1. To make students understand the importance of organizational behavior and organization structure.
2. To gain insight about various aspects related to individuals behavior in an organization.
3. To comprehend the foundations of Group behavior in organization
4. To expose students to various leadership styles and the influence of Power and politics in organization.
5. To enable students familiar with organizational culture and the dynamics of organizational behavior.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Manager's functions, roles and skills. Organizational behavior: Definition – contributing disciplines - challenges and opportunities – Developing an OB Model - Organizational behaviour models. Organization structure: key elements – common organizational designs - determinants.	9
II	**INDIVIDUAL BEHAVIOUR** Personality: Definition - determinants – MBTI, Big Five, 16 PF and other personality traits. Values – terminal Vs instrumental values. Emotions - Emotional Labour – Emotional Intelligence. Attitude – components – major job attitudes. Job satisfaction: causes – consequences. Perception – factors influencing perception – attribution theory. Motivation – early theories – contemporary theories.	9
III	**GROUP BEHAVIOUR** Groups: Meaning – stages of group development – properties – group decision making. Teams: Types – creating effective teams. Communication: Functions – process – direction of communication – interpersonal communication – organizational communication – barriers.	9
IV	**LEADERSHIP AND POWER** Leadership: Meaning – trait theories, behavioural theories, contingency theories. Power – bases of power – power tactics. Politics – causes and consequences. Impression Management.	9
V	**ORGANIZATIONAL CULTURE AND DYNAMICS** Organizational culture: Definition – functions – creating and sustaining culture. Organizational change: forces – planned change – resistance to change – approaches to manage change. Stress: Meaning – potential sources – consequences of stress – Managing stress.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Understand the importance of organizational behavior and organization structure.
CO2: Understand aspects like personality, learning, emotions, attitudes, perceptions, motivation etc which affects individual's behavior in an organization.
CO3: Remember and Understand how to handle group behavior effectively.
CO4: Remember and Understand various leadership styles and the influence of Power and Politics in organization.
CO5: Understand organizational culture and the dynamics of organizational behavior.

REFERENCE BOOKS:

R1 - Fred Luthans, "Organizational Behavior", McGraw Hill, 12th Edition, 2013.
R2 - Steven McShane and Mary Von Glinow , "Organizational Behavior", 4th Edition, 2019.
R3- Schermerhorn, Hunt and Osborn, "Organizational behavior", John Wiley, 9th Edition, 2011.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3308	RESEARCH METHODOLOGY	3	0	0	3

COURSE OBJECTIVE

1. To identify appropriate research problem,
2. To Understand the process of Literature Review
3. To write a research report and thesis
4. To understand the basis of IPR
5. To understand all information regarding Patent

Unit	Description	Instructional Hours
I	**RESEARCH PROBLEM FORMULATION** Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations.	9
II	**LITERATURE REVIEW** Effective literature studies approaches, analysis, plagiarism, and research ethics.	9
III	**TECHNICAL WRITING /PRESENTATION** Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.	9
IV	**INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	9
V	**INTELLECTUAL PROPERTY RIGHTS (IPR)** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases.Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1. Ability to formulate research problem
CO2. Ability to carry out research analysis
CO3. Ability to follow research ethics
CO4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO5. Ability to understand about IPR and filing patents in R & D.

REFERENCE BOOKS:

R1. Garg.B.L., Karadia, R., Agarwal,F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
R2. Kothari, C.R.(2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi.
R3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
R4. Gupta S.P. (2008). Statistical Methods. 37 th ed. (Rev)Sultan Chand and Sons. New Delhi. 1470 p.
R5. Leon & Leon (2202). Internet for everyone, Vikas Publishing House.
R6. Wadehra, B.L.2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
R7. Research Methodology Dr P M Bulakh,Dr P. S. Patki and Dr A S Chodhary 2010 Published by Expert Trading Corporation Dahisar West, Mumbai 400068

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3309	SEMANTIC WEB SERVICES	3	0	0	3

COURSE OBJECTIVE

1. To learn the fundamentals of semantic web and to conceptualize and depict ontology for semantic web.
2. To make a study of languages for semantic web.
3. To learn about the ontology learning algorithms and to utilize in the development of an application.
4. To know the fundamental concepts of ontology management.
5. To learn the applications related to semantic web.

Unit	Description	Instructional Hours
I	**THE QUEST FOR SEMANTICS** Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.	9
II	**LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES** Web Documents in XML – RDF – Schema – Web Resource Description using RDF – RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics –Traditional Ontology Languages – LOOM – OKBC – OCML – FLogic Ontology Markup Languages – SHOE – OIL – DAML + OIL – OWL	9
III	**ONTOLOGY LEARNING FOR SEMANTIC WEB** Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Methods for Evaluating Ontologies	9
IV	**ONTOLOGY MANAGEMENT AND TOOLS** Overview – Need for Management – Development Process – Target Ontology – Ontology Mapping – Skills Management System – Ontological Class – Constraints – Issues, Evolution – Development Of Tools And Tool Suites – Ontology Merge Tools – Ontology Based Annotation Tools.	9
V	**APPLICATIONS** Web Services – Semantic Web Services – Case Study for Specific Domain – Security Issues – Web Data Exchange and Syndication - Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Create ontology for a given domain.
CO2: Develop an application using ontology languages and tools.
CO3: Understand the concepts of semantic web.
CO4: Use ontology related tools and technologies for application creation.
CO5: Design and develop applications using semantic web.

REFERENCES BOOKS:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with Examples from the Areas of Knowledge Management, Ecommerce and the Semantic Web", Springer, 2004.
3. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004.
4. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.
5. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley, 2003.
6. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley, 2006.

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CO'S, PO'S & PSO'S MAPPING

Academic Year 2021 - 2022 - Semester – I - Btach 2021 - 2023

Course Code & Name **21MA1101** **Probability And Statistics, Operations Research**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P 10	P 11	P 12	PSO1	PSO2
CO1	2	3	2	1	1	-	0	0	0	0		1	2	2
CO2	2	3	2	1	1	-	-	-	-	-		1	2	2
CO3	2	2	2	2	2	-	-	-	-	-		1	2	2
CO4	3	3	3	1	2	2	-	-	-	-	1	2	2	2
CO5	3	3	3	2	2	1	-	-	-	-	1	2	2	3
Average	2.4	2.8	2.4	1.4	1.6	2	0	0	0	0	1	1.4	2	2.2

Course Code & Name **21CA1201** **UI Design & Development**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.6

Course Code & Name **21CA1202** **Computer Networks**

PO&PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO1	2	3	2	1			0	0	0	0	0	0	2	3
CO2	2	1	2	3	2	1	0	0	0	0	0	0		1
CO3	2	1	2	3	2	1	0	0	0	0	0	0		1
CO4	2	3	2	1			0	0	0	0	0	0	2	3
CO5	2	1	2	3	2	1	0	0	0	0	0	0		1
Average	2	1.8	2	2.2	2	1	0	0	0	0	0	0	2	1.8

Course Code & Name **21CA1203** **Java Programming**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	3	3	0	3	2	0	0	3	3	3	3
CO2	3	3	3	3	3	0	3	2	0	0	3	3	3	3
CO3	3	3	3	3	3	0	3	2	0	0	3	3	3	3
CO4	3	3	3	3	3	0	3	2	0	0	3	3	3	3
CO5	3	3	3	3	3	0	3	2	0	0	3	3	3	3
Average	3	3	3	3	3	0	3	2	0	0	3	3	3	3

Course Code & Name **21CA1204** **Database Management Systems**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3		3		0	0	0	2	3	1
CO2	3	3	3	3	3		3		0	0	0	2	3	1
CO3	3	3	3	3	3	3	3	2	0	0	0	2	3	1
CO4	3	3	3	3	3	3	2	2	0	0	0	2	3	2
CO5	3	3	3	3	3	3	3	2	0	0	0	2	3	1
Average	3	3	3	2.8	3	3	2.8	2	0	0	0	2	3	1.2

Course Code & Name **21CA1001** **Java Programming Lab**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	1	0	3	0	3	3	3	3	1	0	2
CO2	0	0	0	0	0	3	0	3	3	3	3	1	0	2
CO3	0	0	0	0	0	0	0	1	3	3	3	1	0	2
CO4	0	0	0	0	0	0	1	1	3	3	3	1	0	1
CO5	0	0	0	0	0	0	0	1	3	3	3	1	0	2
Average	0	0	0	0.2	0	1.2	0.2	1.8	3	3	3	1	0	1.8

Course Code & Name **21CA1002** **DBMS Lab**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3	0	3	0	0	0	0	0	3	1
CO2	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO3	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO4	3	3	3	3	3	0	2	0	0	0	0	0	3	2
CO5	3	3	3	3	3	0	3	0	0	0	0	0	3	1
Average	3	3	3	2.8	3	0	2.8	0	0	0	0	0	3	1.2

Course Code & Name 21CA1171 Communicative Skill for Business English

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	2	2	2	1	1	2	1	3	3	0	2	2	1
CO2	2	2	0	0	1	2	2	0	2	3	0	2	2	1
CO3	2	2	0	1	2	2	1	1	3	3	0	3	2	1
CO4	2	2	1	0	1	1	0	2	2	2	0	2	2	2
CO5	2	1	1	2	3	2	0	0	2	3	0	2	2	1
Average	2.2	1.8	0.8	1	1.6	1.6	1	0.8	2.4	2.8	0	2.2	2	1.2

CO'S, PO'S & PSO'S MAPPING

Academic Year 2021 - 2022 - Semester – II - Btach 2021 - 2023

Course Code & Name **21CA2201** **Data Structures and Algorithms**

PO&PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	1.6	1.2	1.2	1.2	1.2	1.6	1.2	1.2	1.6	1.2	1.2	1.2	1.2	1.4

Course Code & Name **21CA2202** **Artificial Intelligence**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO2	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	1.4	1.6	1.6	2.2	1.4	1.4	2.2	1.4	1.4	2.2	1.4	1.4	1.4	2.4

Course Code & Name **21CA2203** **Python Programming**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3	0	3	0	0	0	0	0	3	1
CO2	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO3	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO4	3	3	3	3	3	0	2	0	0	0	0	0	3	2
CO5	3	3	3	3	3	0	3	0	0	0	0	0	3	1
average	3	3	3	2.8	3	0	2.8	0	0	0	0	0	3	1.2

Course Code & Name **21EC2231** **Embedded System and Sensors**

PO&PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO1	3	1	2	1	1	-	-	-	0	0	-	1	3	-
CO2	3	2	3	1	1	-	-	-	-	-	-	1	3	-
CO3	3	2	3	2	3	-	1	1	-	-	1	1	2	3
CO4	3	2	3	2	3	-	1	1	-	-	1	1	2	3
CO5	3	1	3	3	3	2	2	2	-	-	1	2	3	3
Average	3	2	3	2	2	2	1	1	0	0	1	1	3	3

Course Code & Name **21CA2001** **Python Programming Lab**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	3	3	0	3		0	0	0		3	1
CO2	3	3	3	3	3		3		0	0	0		3	2
CO3	3	3	3	3	3		3	3	0	0	0	2	3	2
CO4	3	3	3	3	3		3		0	0	0		3	3
CO5	3	3	3	3	3		3		0	0	0		3	3
Average	3	3	3	3	3	0	3	3	0	0	0	2	3	2.2

Course Code & Name **21CA2002** **Data Structures & Algorithms Lab**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average	0.6	1.8	1.8	1.4	1.8	0.6	1.4	1.8	0.6	1.4	1.8	1.8	1.8	1

CO'S, PO'S & PSO'S MAPPING

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Course Code & Name 21CA2301 Cyber Security

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	0	0	0	0	2	0	0	2	0	0	0	0	1
Average	2	0	0	0	0	2	0	0	2	0	0	0	0	1

Course Code & Name 21CA2302 Green Computing

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	2	0.2	0.2	0.4	0	2	0.4	0	2	0.4	0	0	0	1.4

Course Code & Name 21CA2303 Human Computer Interaction

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.2	1.75	1.75	1.2	1	1.2	1.2	1	1.2	1.2	1	1	1	1.4

Course Code & Name 21CA2304 Professional Ethics

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	3	3	1	3	3	1	3	3	3	3	2
CO2	1	2	2	1	2	1	1	2	1	1	2	2	2	0
CO3	3	0	0	1	3	3	1	3	3	1	3	3	3	2
CO4	0	0	0	0	2	0	0	2	0	0	2	2	2	0
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	1.6	1.6	1.6	1.6	2	1.6	1.6	2	1.6	1.6	2	2	2	1.4

Course Code & Name **21CA2305** **Web Graphics**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	0	3	0	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	3	3	2.4	3	1.8	3	3	2.4	3	3	2.4	2.4	2.4	3

Course Code & Name **21CA2306** **Digital Logic and Computer Organization**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO3	0	0	0	0	3	0	0	3	0	0	3	3	3	0
CO4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6

Course Code & Name **21CA2307** **E-Learning Techniques**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	1	2	2	1.4	1.5	1	1.4	1.5	1	1.4	1.5	1.5	1.5	1.2

Course Code & Name **21CA2308** **Block Chain technologies**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	1.2	1.75	1.75	1.2	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5	1.5	1.4

CO'S, PO'S & PSO'S MAPPING

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Course Code & Name 20CA3201 Big Data Analytics

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.4	0.4	0.4	1.2	0.4	2.4	1.2	0.4	2.4	1.2	0.4	0.4	0.4	2.2

Course Code & Name 20CA3202 Operating Systems

	PO1	PO2	PO3	PO4	**PO5**	PO6	PO7	PO8	PO9	**PO10**	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	**0**	3	1	0	3	**1**	0	0	0	2
CO2	3	0	0	1	**0**	3	1	0	3	**1**	0	0	0	2
CO3	3	0	0	1	**0**	3	1	0	3	**1**	0	0	0	2
CO4	3	0	0	1	**0**	3	1	0	3	**1**	0	0	0	2
CO5	3	0	0	1	**0**	3	1	0	3	**1**	0	0	0	2
Average	3	0	0	1	0	3	1	0	3	1	0	0	0	2

2

Course Code & Name 0CA3203 Web Development

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.6	1.4	1.4	1.6	0.8	1.6	1.6	0.8	1.6	1.6	0.8	0.8	0.8	1.8

Course Code & Name 20CA3204 Artificial Intelligence

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	3	0	0	1	0	3	1	0	3	1	0	0	0	2

CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	2.4	0.6	0.6	1.6	0.2	2.4	1.6	0.2	2.4	1.6	0.2	0.2	0.2	2.2

Course Code & Name **20CA3002** **Web Development Lab**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	0	3	3	2	3	0	2	3	0	2	3	3	3	1

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Course Code & Name **20CA3301** **Block Chain**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	1.2	1.75	1.75	1.2	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5	1.5	1.4

Course Code & Name **20CA3302** **Cloud Computing**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	2.4	0.5	0.5	1.2	0	2.4	1.2	0	2.4	1.2	0	0	0	1.8

Course Code & Name **20CA3303** **Cryptography and Network Security**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	3	3	3	3	2.4	3	3	2.4	3	3	2.4	2.4	2.4	3

Course Code & Name 20CA3304 Deep Learning

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.2	0	0	0.2	0	2.2	0.2	0	2.2	0.2	0	0	0	1.2

Course Code & Name 20CA3305 E-Commerce

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.4	0.6	0.6	1.2	0.6	2.4	1.2	0.6	2.4	1.2	0.6	0.6	0.6	1.8

Course Code & Name 20CA3306 Mixed Learning

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	2	0.7	0.7	0.8	0.3	2.0	0.8	0.3	2.0	0.8	0.3	0.3	0.3	1.8

Course Code & Name 20CA3307 Organizational Behaviour

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3

CO5	2	FALSE	FALSE	0	0	2	0	0	2	0	0	0	0	1
Average	2	0.75	0.75	1.2	0.6	2	1.2	0.6	2	1.2	0.6	0.6	0.6	2.2

Course Code & Name **20CA3308** **Research Methodology**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	2.0	1.0	1.0	1.2	0.7	2.0	1.2	0.7	2.0	1.2	0.7	0.7	0.7	1.8

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Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
I	I	21MA1101- Probability, Statistics and Opertaion Resaerch	2.4	2.8	2.4	1.4	1.6	2	0	0	0	0	1	1.4	2	2.2
		20CA1201- UI Fesign and Development	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.6
		21CA1202 Computer Networks	2	1.8	2	2.2	2	1	0	0	0	0	0	0	2	1.8
		20CA1203 - Java Programing	3	3	3	3	3	0	3	2	0	0	3	3	3	3
		21CA1204 - Database management system	3	3	3	2.8	3	3	2.8	2	0	0	0	2	3	1.2
		20CA1001 - Java Programing Lab	0	0	0	0.2	0	1.2	0.2	1.8	3	3	3	1	0	1.8
		21CA1002 - Database management system Lab	3	3	3	2.8	3	0	2.8	0	0	0	0	0	3	1.2
		21CA1171 - Communication Skill for Business English	2.2	1.8	0.8	1	1.6	1.6	1	0.8	2.4	2.8	0	2.2	2	1.2

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Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
II	II	21CA2201 Dtata Structures and algorithms	1.6	1.2	1.2	1.2	1.2	1.6	1.2	1.2	1.6	1.2	1.2	1.2	1.2	1.4
		20CA2202 - Artificial Intelligence	1.4	1.6	1.6	2.2	1.4	1.4	2.2	1.4	1.4	2.2	1.4	1.4	1.4	2.4
		21CA2203 - Python Programming	3	3	3	2.8	3	0	2.8	0	0	0	0	0	3	1.2
		21EC2231 Embedded system ans Sensors	3.0	1.6	2.8	1.8	2.2	2.0	1.3	1.3	0.0	0.0	1.0	1.2	2.6	3.0
		21CA2001 - Python Programming Lab	3	3	3	3	3	0	3	3	0	0	0	2	3	2.2
		21CA2002 - Data Structures and Algorithms Lab Programing Lab	0.6	1.8	1.8	1.4	1.8	0.6	1.4	1.8	0.6	1.4	1.8	1.8	1.8	1

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Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
I	Electives Sem II	21CA2301 - Cyber Security	2	0	0	0	0	2	0	0	2	0	0	0	0	1
		21CA2302 - Green Computing	2	0.2	0.2	0.4	0	2	0.4	0	2	0.4	0	0	0	1.4
		21CA2303 - Human Computer Interaction	1.2	1.75	1.75	1.2	1	1.2	1.2	1	1.2	1.2	1	1	1	1.4
		21CA2304 - Professional Ethics	1.6	1.6	1.6	1.6	2	1.6	1.6	2	1.6	1.6	2	2	2	1.4
		21CA2305 - Web Graphics	3	3	2.4	3	1.8	3	3	2.4	3	3	2.4	2.4	2.4	3
		21CA2306 - Digital Logic and Compute Organization	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
		21CA2307 - E-Learning	1	2	2	1.4	1.5	1	1.4	1.5	1	1.4	1.5	1.5	1.5	1.2
		21CA2308 - Block Chain Technologies	1.2	1.75	1.75	1.2	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5	1.5	1.4

Academic Year 2021 - 2022 - Semester – III - Batch (2020 - 2022)

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
II	III	20CA3201 - Big Data Analytics	2.4	0.4	0.4	1.2	0.4	2.4	1.2	0.4	2.4	1.2	0.4	0.4	0.4	2.2
		20CA3202 - Opearting System	3	0	0	1	0	3	1	0	3	1	0	0	0	2
		20CA3203 - Web Development	1.6	1.4	1.4	1.6	0.8	1.6	1.6	0.8	1.6	1.6	0.8	0.8	0.8	1.8
		20CA3204 - Artificial Intelligence	2.4	0.6	0.6	1.6	0.2	2.4	1.6	0.2	2.4	1.6	0.2	0.2	0.2	2.2
		20CA3002 - Web Development Lab	0	3	3	2	3	0	2	3	0	2	3	3	3	1

Academic Year 2021 - 2022 - Semester – III - Batch (2020 - 2022) - List of Electives

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
I	Electives Sem II	20CA3301 - Block Chain	1.2	1.75	1.75	1.2	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5	1.5	1.4
		20CA3302 - Cloud Computing	2.4	0.5	0.5	1.2	0	2.4	1.2	0	2.4	1.2	0	0	0	1.8
		20CA3303 - Cryptography and Network Security	3	3	3	3	2.4	3	3	2.4	3	3	2.4	2.4	2.4	3
		20CA3304 - Deep learning	2.2	0	0	0.2	0	2.2	0.2	0	2.2	0.2	0	0	0	1.2
		20CA3305 - E-Commerce	2.4	0.6	0.6	1.2	0.6	2.4	1.2	0.6	2.4	1.2	0.6	0.6	0.6	1.8
		20CA3306 - Mixed Learning	2.0	0.7	0.7	0.8	0.3	2.0	0.8	0.3	2.0	0.8	0.3	0.3	0.3	1.8
		20CA3307 - Organization Behaviour	2	0.75	0.75	1.2	0.6	2	1.2	0.6	2	1.2	0.6	0.6	0.6	2.2
		20CA3308 - Research Methodology	2.0	1.0	1.0	1.2	0.7	2.0	1.2	0.7	2.0	1.2	0.7	0.7	0.7	1.8

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2301	CYBER SECURITY	3	0	0	3

COURSE OBJECTIVE

1. Able to utilize various disk forensic tools to analyze and extract relevant information from digital storage media.
2. Able to utilize relevant forensic tools to identify and analyze code vulnerabilities and potential security threats.
3. To analyze complex network scenarios to identify abnormal communication patterns indicative of security breaches.
4. To analyze the role of digital forensics in the broader context of cybersecurity.

To evaluate the effectiveness of different incident response strategies in mitigating and preventing security incidents.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**DISK FORENSICS** Computer Forensics - Digital data – digital object – digital event – digital device- Hard disk – types of disc – Disk characteristics – file systems - Headers/Magic Numbers- Registry Forensics - Registry – registry data types –RegEdit - Data hiding.	9
II	**SOFTWARE FORENSICS** Live Forensics, Volatile Live Vs Offline Forensics, Artifacts - System Information - Linux - Windows – System commands - Network information – Network commands - Live Forensics scenarios- Obfuscation – code Obfuscation - data hiding in Images - Software Forensic challenges – Principles of Steganography.	9
III	**NETWORK FORENSICS** Network forensics - vulnerability analysis - Malware Concepts - Virus components- Function of replicator, concealer and dispatcher- Trigger Mechanisms- Virus families - worms & virus - sandboxing - Key Loggers - Port Scans – SYN flood - Email Forensics - email spoofing – Phishing – mail header analysis - Network forensics- Wireshark – Capture and Display Filters - pcap analysis- DoS – DDoS Attacks – types - Honey Pots - Forensic evidences - log analysis & evidence collection.	9
IV	**CYBER SECURITY INTRODUCTION** History - Critical Characteristics of Information - NSTISSC Security Model - Components an Information system - Securing the components - Balancing Security and Access - The SDLC - The Security SDLC.	9
V	**SECURITY INVESTIGATION AND ANALYSIS** Need for Security - Threats - Attacks – Legal - Ethical and Professional Issues -Risk Management- Identifying and assessing - Risk Assessing and Controlling Risk.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Interpret and derive insights from data obtained through Disk forensics investigations, showcasing advanced analytical skills in interpreting digital evidence.

CO2: Scrutinize software artifacts and code for forensic purposes, demonstrating advanced analytical thinking in dissecting digital artifacts.

CO3: Examine network traffic and communication patterns for forensic investigation, demonstrating an advanced understanding of network forensics.

CO4: Assess the role of digital forensics in ensuring cybersecurity, showcasing a high level of synthesis in understanding the broader implications of digital forensics in cybersecurity.

CO5: Investigate security incidents and conduct effective analyses, demonstrating a high level of synthesis and creativity in responding to and investigating security incidents.

REFERENCE BOOKS:

1. Albert J Marcella, et al, Cyber forensics, 2nd edition, Auerbach, 2008
2. Harlon Carvey, Windows Registry forensics, Syngress, 2011
3. Andrew Hoog, Android forensics, Syngress,2011

4. Michael E Whitman and Herbert J Mattord, "Principles of information Security", Vikas Publishing House, New Delhi,2003

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Interpret and derive insights from data obtained through Disk forensics investigations, showcasing advanced analytical skills in interpreting digital evidence.	3	3	2	2	2	3	1	2	-	-	-	-
CO2	Scrutinize software artifacts and code for forensic purposes, demonstrating advanced analytical thinking in dissecting digital artifacts.	3	3	2	2	2	3	1	2	-	-	-	-
CO3	Examine network traffic and communication patterns for forensic investigation, demonstrating an advanced understanding of network forensics	3	3	2	2	2	3	1	2	-	-	-	-
CO4	Assess the role of digital forensics in ensuring cybersecurity, showcasing a high level of synthesis in understanding the broader implications of digital forensics in cybersecurity.	3	3	2	2	2	3	1	2	-	-	-	-
CO5	Investigate security incidents and conduct effective analyses, demonstrating a high level of synthesis and creativity in responding to and investigating security incidents.	3	3	2	2	2	3	1	2	-	-	-	-
	CO PO Mapping Average Value	**2**	-	-	-	-	**2**	-	-	**2**	-	-	-

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2302	GREEN COMPUTING	3	0	0	3

COURSE OBJECTIVE

1. Able reduce power consumption and environmental impact in various computing environments.
2. To evaluate the impact of energy-saving practices on overall system performance and resource utilization.
3. To analyze the environmental impact of different technology tools aimed at reducing paper waste.
4. To analyze the lifecycle of computing equipment to identify opportunities for reducing the need for disposal.
5. Able to evaluate the effectiveness of implemented green computing strategies in achieving sustainability goals.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**FUNDAMENTALS** Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.	9
II	**GREEN ASSETS AND MODELING** Green Assets: Buildings- Data Centers- Networks and Devices – Green Business Process - Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.	9
III	**GRID FRAMEWORK** Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework	9
IV	**GREEN COMPLIANCE** Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	9
V	**CASE STUDIES** The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Apply knowledge to adopt green computing practices in different scenarios.
CO2: Examine energy-saving practices to efficiently use hardware resources
CO3: Evaluate and select technology tools that can effectively reduce paper waste and carbon footprint.
CO4: Assess knowledge to implement practices that reduce the need for equipment disposal.
CO5: Implement knowledge to address specific scenarios and implement green computing strategies.

REFERENCE BOOKS:

1. BhuvanUnhelkar, —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 & industry, Lulu.com, 200

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply knowledge to adopt green computing practices in different scenarios.	3	3	2		1	2		-	2			
CO2	Examine energy-saving practices to efficiently use hardware resources	3	3	2		1	2		-	2			
CO3	Evaluate and select technology tools that can effectively reduce paper waste and carbon footprint.	3	3	2		1	2		-	2			
CO4	Assess knowledge to implement practices that reduce the need for equipment disposal.	3	3	2		1	2		-	2			
CO5	Implement knowledge to address specific scenarios and implement green computing strategies.	3	3	1	2	1	2	2	-	2			
	CO PO Mapping Average Value	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2303	HUMAN COMPUTER INTERACTION	3	0	0	3

COURSE OBJECTIVE

1. Able to design inclusive HCI solutions that consider the diverse needs of individuals, including those with disabilities.
2. To evaluate the effectiveness of different feedback collection methods in capturing user preferences and concerns.
3. Able to interact elements that enhance the user experience in these specific contexts.
4. Able to implement best practices for creating interfaces that align with user expectations and needs.
5. Able to evaluate the impact of emerging technologies on user interaction and interface design.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**FOUNDATIONS OF HCI** The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9
II	**DESIGN & SOFTWARE PROCESS** Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	9
III	**MODELS AND THEORIES** Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	9
IV	**MOBILE HCI** Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	9
V	**WEB INTERFACE DESIGN** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Design effective dialog for HCI and effective HCI for individuals and persons with disabilities.
CO2: Assess the importance of user feedback.
CO3: Apply the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO4: Develop meaningful user interface.
CO5: Develop the recent technologies with real world examples.

REFERENCE BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III).
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009 (UNIT –IV).
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (UNIT-V).

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design effective dialog for HCI and effective HCI for individuals and persons with disabilities.	2	-	-	-	-	2	-	-	2	-	-	0
CO2	Assess the importance of user feedback.	-	3	3	2	3	-	2	3	-	2	3	3
CO3	Apply the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.	2	-	-	-	-	2	-	-	2	-	-	0
CO4	Develop meaningful user interface.	2	1	1	2	1	2	2	1	2	2	1	1
CO5	Develop the recent technologies with real world examples.	-	3	3	2	-	-	2	-	-	2	-	0
	CO PO Mapping Average Value	**2.0**	**2.3**	**2.3**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2304	PROFESSIONAL ETHICS	3	0	0	3

COURSE OBJECTIVE

1. To analyze the ethical implications of specific computer-related actions and decisions.
2. Able to implement strategies to protect and enforce intellectual property rights in computer-related contexts.
3. To critically evaluate the global impact of internet regulations on cybersecurity and user privacy.
4. To evaluate the suitability of specific concepts for solving complex problems in diverse computing environments.
5. Able to critically evaluate emerging models of software development and their potential advantages over traditional approaches.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**HUMAN VALUES AND COMPUTER ETHICS** A general Introduction – Morals, Values and Ethics – Integrity – Work Ethic – Civic virtue – Respect For Others – Caring – Sharing – Honesty – Computer ethics: an overview – Identifying an ethical issue – Ethics and law – Ethical theories - Professional Code of conduct – An ethical dilemma – A framework for ethical decision making - Computer hacking – Introduction – definition of hacking – Destructive programs – hacker ethics – Professional constraints – BCS code of conduct – To hack or not to hack? – Ethical positions on hacking	9
II	**ASPECTS OF COMPUTER CRIME AND INTELLECTUAL PROPERTY RIGHTS** Aspects of computer crime - Introduction - What is computer crime – computer security measures – Professional duties and obligations - Intellectual Property Rights – The nature of Intellectual property – Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues, Copyright - The extent and nature of software piracy – Ethical and professional issues – free software and open-source code	9
III	**REGULATING INTERNET CONTENT, TECHNOLOGY AND SAFETY** Introduction – In defence of freedom expression – censorship – laws upholding free speech – Free speech and the Internet - Ethical and professional issues - Internet technologies and privacy – Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk	9
IV	**COMPUTER TECHNOLOGIES ACCESSIBILITY ISSUES** Introduction – Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace – Introduction – computers and employment – computers and the quality of work – computerized monitoring in the work place – telecommuting – social, legal and professional issues - Use of Software, Computers and Internet-based Tools - Liability for Software errors - Documentation Authentication and Control – Software engineering code of ethics and practices – IEEE-CS – ACM Joint task force	9
V	**SOFTWARE DEVELOPMENT AND SOCIAL NETWORKING** Software Development – strategies for engineering quality standards – Quality management standards – Social Networking – Company owned social network web site – the use of social networks in the hiring process – Social Networking ethical issues – Cyber bullying – cyber stalking – Online virtual world – Crime in virtual world - digital rights management - Online defamation – Piracy – Fraud	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Recognize human values and ethical principles relevant to computer usage.
CO2: Apply the principles and concepts of computer crime and intellectual property rights.
CO3: Apply regulatory and safety concepts to ensure secure and responsible use of the internet.
CO4: Implement the fundamental concepts and principles of various computer technologies.
CO5: Recognize models of software development and quality standards

REFERENCE BOOKS:

1. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical , legal and professional issues in computing", Middlesex University Press, 2008
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2011

3. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2011
4. Richard Spinello, "Case Studies in Information and Computer Ethics", Prentice Hall, 1997.
5. http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Recognize human values and ethical principles relevant to computer usage.	1	3	3	3	3	1	3	3	1	3	3	1
CO2	Apply the principles and concepts of computer crime and intellectual property rights.	1	2	2	1	2	1	1	2	1	1	2	1
CO3	Apply regulatory and safety concepts to ensure secure and responsible use of the internet.	3	-	-	1	3	3	1	3	3	1	3	3
CO4	Implement the fundamental concepts and principles of various computer technologies.	-	-	-	-	2	-	-	2	-	-	2	-
CO5	Recognize models of software development and quality standards	3	3	3	3	-	3	3	-	3	3	-	3
	CO PO Mapping Average Value	**2.0**	**2.7**	**2.7**	**2.0**	**2.5**	**2.0**	**2.0**	**2.5**	**2.0**	**2.0**	**2.5**	**2.0**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2305	WEB GRAPHICS	3	0	0	3

COURSE OBJECTIVE

1. To demonstrate the ability to use HTML tags to format text, insert images, and create hyperlinks.
2. Able to analyze the impact of image quality and resolution on web page design and loading times.
3. To evaluate the impact of Flash on webpage loading times and overall performance.
4. To evaluate the precision and clarity of using specific terms in different communication scenarios.
5. To evaluate the integration of HTML, CSS, and Flash elements to achieve specific design goals.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**INTRODUCTION** HTML coding - Basic web graphics - Web page design and site building - Image maps - Adding multimedia to the web- Vector and Raster graphics.	9
II	**RASTER IMAGE EDITING SOFTWARE** Introduction - Image Basics - File Formats - GIF - JPEG - Color Palette – Color models Layers - Creating new Images - Brushes – Grids and Guides- Gradients - Scaling Images - Moving and Merging Layers - Tool Palette - Dialogs - Masking – Filters – Adding text to images – Designing icons and background images.	9
III	**VECTOR IMAGE HANDLING** Introduction – Creating Simple Vector graphics – Creating banners -Images - Working with layers – Tweening - Motion guide – Masking – Frame by Frame animation – Onion Skin Effect – Creating special effects - Text effects and animation – Action scripts.	9
IV	**MULTIMEDIA** Creating clippings - Animations with sound effects - Adding audio or Video - Windows Media Player ActiveX Control - Agent control - Embedding VRML in a web page - Real Player ActiveX control.	9
V	**APPLICATIONS** Creating web site with a particular theme using all the utilities - Graphics - Animations and Interaction.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Recall the fundamental concepts of HTML for creating simple websites.
CO2: Utilize image editing software tools to design web pages effectively.
CO3: Develop a Flash website by applying the principles and techniques learned
CO4: Explain a variety of terms related to web design, HTML, CSS, and Flash accurately.
CO5: Design, create, and evaluate an original website, demonstrating proficiency in HTML, CSS, and Flash.

REFERENCE BOOKS :

1. Jon Duckett, HTML & CSS design and Build Web SitesJohn Wiley & Sons, 2011.
2. Andrew Rapo, Alex Michael,"Understanding Macromedia Flash 8 ActionScript 2: Basic Techniques for Creatives," Focal press Taylorand Francis group, 2013
3. Andrew Faulkner, Conrad ChavezAdobe Photoshop CC Classroom in a Book (2017 release)

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Recall the fundamental concepts of HTML for creating simple websites.	3	3	-	-	-	1	1	1	-	1	-	-
CO2	Utilize image editing software tools to design web pages effectively.	3	3	3	2	3	1	1	1	-	-	-	-
CO3	Develop a Flash website by applying the principles and techniques learned	3	3	3	2	3	1	1	1	-	1	-	-
CO4	Explain a variety of terms related to web design, HTML, CSS, and Flash accurately.	3	3	3	-	-	1	1	1	-	1	-	-
CO5	Design, create, and evaluate an original website, demonstrating proficiency in HTML, CSS, and Flash.	3	3	3	2	3	1	1	1	-	3	-	-
	CO PO Mapping Average Value	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**-**	**1.5**	**-**	**-**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2306	DIGITAL LOGIC AND COMPUTER ORGANIZATION	3	0	0	3

COURSE OBJECTIVE

1. To critically evaluate the trade-offs and advantages of different number systems in specific computing applications.
2. To evaluate the efficiency and reliability of different design choices in digital systems.
3. Able to analyze the trade-offs involved in memory hierarchy organization and cache design.
4. To evaluate the efficiency and performance implications of different instruction formats.
5. To critically evaluate the trade-offs involved in choosing between program-controlled I/O and interrupt I/O strategies.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**DIGITAL FUNDAMENTALS** Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – L1ogic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.	9
II	**COMBINATIONAL AND SEQUENTIAL CIRCUITS** Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters	9
III	**COMPUTER FUNDAMENTALS** Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High-Level Language (C language).	9
IV	**PROCESSOR** Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
V	**MEMORY AND I/O** Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel And Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Demonstrate a strong comprehension of number systems and computer arithmetic, showcasing proficiency in performing operations within these systems.

CO2: Design and implement digital systems using basic gates and other components through the application of combinational and sequential circuits.

CO3: Analyze and comprehend the organization of memory hierarchies, including the basics of cache design and subsystems.

CO4: Execute Instruction Set Architecture (ISA), including understanding basic instruction fetch and execute cycles, instruction formats, and control flow within a machine.

CO5: Evaluate the functioning of basic input/output mechanisms, including program-controlled I/O and interrupt I/O, and analyze the performance of processors and caches.

REFERENCE BOOKS:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013.
3. Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
5. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2008.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Demonstrate a strong comprehension of number systems and computer arithmetic, showcasing proficiency in performing operations within these systems.	1	1	1	2	1	1	1	-	-	-	2	1
CO2	Design and implement digital systems using basic gates and other components through the application of combinational and sequential circuits.	1	2	1	2	1	1	2	-	-	-	2	1
CO3	Analyze and comprehend the organization of memory hierarchies, including the basics of cache design and subsystems.	1	1	1	2	1	-	2	3	-	-	2	1
CO4	Execute Instruction Set Architecture (ISA), including understanding basic instruction fetch and execute cycles, instruction formats, and control flow within a machine.	1	1	2	2	1	1	2	-	1	-	2	1
CO5	Evaluate the functioning of basic input/output mechanisms, including program-controlled I/O and interrupt I/O, and analyze the performance of processors and caches.	1	1	2	2	1	-	2	-	1	-	2	1
	CO PO Mapping Average Value	**1**	**1.2**	**1.4**	**2**	**1**	**1**	**1.8**	**0.6**	**1**	**-**	**2**	**1**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2307	E-LEARNING TECHNIQUES	3	0	0	3

COURSE OBJECTIVE

1. Understand the need for E-Learning, explore different approaches, components, and modes, and gain insights into blended learning and design thinking basics.
2. Learn about design models, needs analysis, target audience analysis, learning objectives, instructional methods, and evaluation and delivery strategies.
3. Develop skills in preparing interactive content, creating storyboards, presenting content effectively, integrating multimedia elements, and using authoring tools.
4. Explore different types of learning platforms, compare proprietary and open-source LMS, and understand the functional areas of learning management systems.
5. Understand the components of instructor-led courses, plan and document activities, facilitate learner activities, use communication tools, and evaluate E-Learning courses.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning–Blended Learning: Activities, Team and Technology–Work Flow to Produce and Deliver E-Learning Content–Basics of Design Thinking.	9
II	**DESIGNING E-LEARNING COURSE CONTENT** Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis –Analyzing the Target Audience – Identifying Course Content–Defining Learning Objectives–Defining the Course Sequence–Defining Instructional Methods–Defining Evaluation And Delivery Strategies – Case Study	9
III	**CREATING INTERACTIVE CONTENT** Preparing Content: Tips for Content Development and Language Style – Creating Story boards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples –Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests –Adding Additional Resources–Course ware Development – Authoring Tools–Types of Authoring Tools – Selecting an Authoring Tool.	9
IV	**LEARNING PLATFORMS** Types of Learning Platforms–Proprietary Vs. Open –Source LMS – LMS Vs LCMS–Internally Handled and Hosted LMS –LMS Solutions – Functional Areas of LMS.	9
V	**COURSE DELIVERY AND EVALUATION** Components of an Instructor- Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats–Using Communication Tools for E-Learning – Course Evaluation.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Comprehend the fundamentals of E-Learning, its quality aspects, and the workflow involved in producing and delivering E-Learning content.
CO2: Design effective E-Learning course content by identifying audience needs, defining objectives, and selecting appropriate instructional methods.
CO3: Acquire the ability to create engaging and interactive E-Learning content, incorporating multimedia and employing suitable authoring tools.
CO4: Knowledge of various learning platforms, their features, and the differences between LMS and LCMS.
CO5: Develop skills in delivering and evaluating E-Learning courses, ensuring effective communication and interaction in the virtual learning environment

REFERENCE BOOKS:

R1. Clark, R.C. and Mayer, R.E, "e-Learning and the Science of Instruction", Third Edition, JohnWiley,2016.
R2. Means, B., Toyama, Y., and Murphy, R, "Evaluation of Evidence – Based Practices in Online Learning: A Meta – Analysis and Review of Online Learning Studies", Centre for Learning Technologies, 2010.
R3. Crews, T. B., Sheth, S. N., and Horne, T. M, "Understanding the Learning Personalities of Successful Online Students", EducauseReview, 2014.

R4. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media,2017.
R5. Madhuri Dubey, "Effective E–Learning Design, Development and Delivery", University Press,2011.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Comprehend the fundamentals of E-Learning, its quality aspects, and the workflow involved in producing and delivering E-Learning content.	2	1	1	3	1	1	-	2	3	1	2	1
CO2	Design effective E-Learning course content by identifying audience needs, defining objectives, and selecting appropriate instructional methods.	2	1	1	3	1	1	-	2	3	1	2	1
CO3	Acquire the ability to create engaging and interactive E-Learning content, incorporating multimedia and employing suitable authoring tools.	2	1	2	3	1	1	-	1	3	1	2	1
CO4	Knowledge of various learning platforms, their features, and the differences between LMS and LCMS.	2	1	-	3	1	-	-	1	-	1	2	1
CO5	Develop skills in delivering and evaluating E-Learning courses, ensuring effective communication and interaction in the virtual learning environment	2	-	-	3	1	1	-	1	3	1	2	1
	CO PO Mapping Average Value	**2**	**1**	**1.3**	**3**	**1**	**1**	**-**	**1.4**	**3**	**1**	**2**	**1**

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2308	BLOCK CHAIN TECHNOLOGIES	3	0	0	3

COURSE OBJECTIVE

1. To evaluate the impact of various technology components on the overall security and efficiency of a blockchain system.
2. To analyze ability to conduct basic analyses of alternative coins.
3. Able to Analyze Ethereum's consensus model and its impact on the security and scalability of the platform.
4. To evaluate the efficiency and scalability of Hyperledger for specific use cases.
5. To critically evaluate the potential disruptiveness and innovation introduced by emerging trends in blockchain technology.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BLOCKCHAIN** History of Block chain – Types of Block chain – Consensus – Decentralization using Block chain – Block chain and Full Ecosystem Decentralization – Platforms for Decentralization.	9
II	**INTRODUCTION TO CRYPTO CURRENCY** Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin– Zcash – Smart Contracts – Ricardian Contracts.	9
III	**ETHEREUM** The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Block chain, Fee Schedule – Supporting Protocols – Solidity Language	9
IV	**HYPERLEDGER** Hyper ledger as Protocol – The Reference Architecture – Hyper ledger Fabric – Distributed Ledger – Corda.	10
V	**ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS** Kadena – Ripple – Root stock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Block chain Research	8
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Gain foundational knowledge about block chain, its evolution, and the principles of decentralization.
CO2: Understand the fundamentals of crypto currencies, including Bitcoin, digital transactions, and the challenges faced by these digital currencies.
CO3: Gain insights into Ethereum's architecture, programming languages, and its role in decentralized applications
CO4: Comprehend the Hyper ledger framework, its components, and its application in building distributed ledger systems.
CO5: Familiar with various block chain platforms, their unique features, challenges, and emerging trends in the block chain ecosystem.

REFERENCE BOOKS:

R1. ImranBashir, "Mastering Block chain: Distributed Ledger Technology Decentralization and Smart Contracts Explained", 2nd, Edition, Packt Publishing, 2018.
R2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-on Approach", VPT Publisher, 2017.
R3. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
R4. Roger Wattenhofer, "The Science of the Blockchain," CreateSpace Independent Publishing, 2016.
R5. A.Narayanan, J.Bonneau,E. Felten, A. Miller, S .Goldfeder, "Bitcoin and Crypto currency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
R6. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Gain foundational knowledge about block chain, its evolution, and the principles of decentralization.	3	3	3	1	2	2	-	-	-	2	-	-
CO2	Understand the fundamentals of crypto currencies, including Bitcoin, digital transactions, and the challenges faced by these digital currencies.	3	3	3	-	2	2	-	-	--	2	-	-
CO3	Gain insights into Ethereum's architecture, programming languages, and its role in decentralized applications	3	3	3	-	2	2	-	-	-	2	-	-
CO4	Comprehend the Hyper ledger framework, its components, and its application in building distributed ledger systems.	3	3	3	1	2	2	-	-	-	2	-	-
CO5	Familiar with various block chain platforms, their unique features, challenges, and emerging trends in the block chain ecosystem.	3	3	3	1	2	2	-	-	-	2	-	-
	CO PO Mapping Average Value	**3**	**3**	**3**	**1**	**2**	**2**	-	-	-	**2**	-	-

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3301	ACCOUNTING AND FINANCIAL MANAGEMENT	3	0	0	3

COURSE OBJECTIVE

1. To Enables the students to understand the basic accounting concepts and preparation of financial statements
2. To Enable the students to understand the various techniques in financial statement analysis.
3. To Enable the students to understand the analysis of fund flow and cash flow and application of cost accounting technique to ascertain the cost of products and services
4. To Enables students to understand the application of marginal costing techniques, preparation and presentation of budgets in business
5. To Expose the students to understand the concept of financial management, time value of money and investment decision on projects

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	**FINANCIAL ACCOUNTING** Financial Accounting – Accounting Concepts and conventions - Double entry principles of book keeping -Journal entry- Ledger-Trial Balance- Final Accounts.	9
II	**FINANCIAL STATEMENT ANALYSIS** Analysis of financial statements -Techniques of financial analysis - Comparative Statement-Common size statement-Trend Analysis-RatioAnalysis.	9
III	**COST AND MANAGEMENT ACCOUNTING** Management Accounting – Funds Flow Analysis - Cash Flow Analysis - Cost Accounting-Functional classification of cost - Preparation of Cost Sheet	9
IV	**MARGINAL COSTING AND BUDGETARY CONTROL** Marginal costing - Break Even Analysis- Applications of marginal costing- Meaning of budget and budgetary control. Preparation of budget -Cash budget- flexible budget and other budgets.	9
V	**FINANCIAL MANAGEMENT** Financial Management - Objectives and functions - Concept of Time value of money-Techniques in computation of time value of money - Capital Budgeting Decision- Methods of appraisal capital budgeting.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Basic principles of financial accounting, enabling them to record transactions and prepare essential financial statements.
CO2: Acquire skills to interpret and analyze financial statements, evaluating the financial health and performance of an organization.
CO3: Students will understand the analysis of fund flow and cash flow and application of cost accounting technique to ascertain the cost of products and services
CO4: Students will understand the application of marginal costing techniques, preparation and presentation of budgets in business
CO5: Students will understand concept of financial management, time value of money and investment decision on projects.

REFERENCE BOOKS:

1.R.S.N. Pillai and V.Bagavathi, Financial Accounting, S.Chand publishing, New Delhi 2019.
2.R.S.N. Pillai and V.Bagavathi, Cost Accounting, S.Chand publishing, New Delhi 2019
3. M Y Khan and P K Jain, Financial Management– Text, Problems and Cases, Tata McGraw Hill, New Delhi 2019.
4. John J.Hampton, —Financial Decision Making –Concepts, Problems and Casesl Prentice Hall of India (P) Ltd., New Delhi, 2019

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