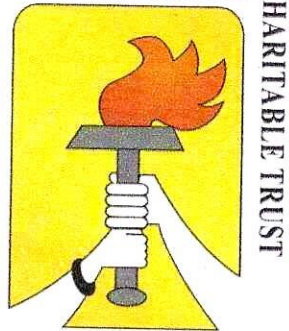


**HINDUSTHAN
EDUCATIONAL AND**



HICET

***HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY***

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF COMPUTER APPLICATIONS

Curriculum and Syllabus for the Batch 2022-2024

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

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
<p>To achieve the vision of the department with sustained efforts to,</p> <p>DM1: To achieve academic excellence in computer applications related education through Novel teaching methods to equip students with required skills.</p> <p>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.</p> <p>DM3: To produce dedicated professionals with a strong sense of social responsibility, emphasizing ethical practices in technology and to make meaningful contributions to society.</p>

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 consideration.
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 2022-2023 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.	21CA1251	UI Design & Development	PC	3	0	2	4	50	50	100
3.	21CA1202	Computer Networks	PC	3	0	0	3	40	60	100
4.	21CA1203R	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.	21CA1001R	Java Programming Lab	EEC	0	0	3	1.5	60	40	100
7.	21CA1002	DBMS Lab	EEC	0	0	3	1.5	60	40	100
8.	21CA1171	Communicative Skill for Business English	EEC	0	0	2	2	100	---	100
Total				15	3	8	23	430	370	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.	21CA2201R	Data Structures and Algorithms	PC	3	1	0	4	40	60	100
2.	21CA2203R	Python Programming	PC	3	1	0	4	40	60	100
3.	21CA2251	Web Development(T+L)	PC	3	1	0	4	40	60	100
4.	21EC2251	Electronics for Embedded Systems(T+L)	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.	21CA3205	Cryptography and Network Security	IC	3	1	0	4	40	60	100
2.	21CA3206	Deep Learning Techniques	PC	3	1	0	4	40	60	100
3.	21CA3252	Data Visualization using Tableau	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.	21CA3003	Deep Learning Lab	EEC	0	0	3	1.5	60	40	100
Total				17	3	6	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
9.	21CA2309	Introduction to Machine learning	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	21CA3303	Soft Computing Techniques	PE	3	0	0	3	40	60	100
3	21CA3305	E- Commerce	PE	3	0	0	3	40	60	100
4	21CA3306	Mixed Reality	PE	3	0	0	3	40	60	100
5	21CA3307	Organizational Behavior	PE	3	0	0	3	40	60	100
6	21CA3308	Research Methodology	PE	3	0	0	3	40	60	100
7	21CA3309	Semantic Web Services	PE	3	0	0	3	40	60	100
8	21CA3310	Fundamentals of Cloud Computing	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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Principal

**Dr. J. JAYA, M.Tech., Ph.D.
PRINCIPAL**

**Hindustan College of Engineering and Technology
CUMBAITORE - 541 032.**

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

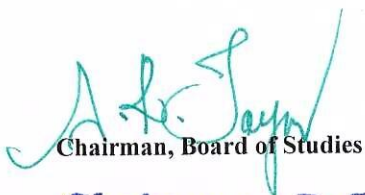
S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	Total
THEORY										
1	21CA4901	Project Work	EEC	0	0	0	14	50	50	100
Total				0	0	0	14	50	50	100

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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Hindusthan College of Engineering and Technology
COIMBATORE - 641 032.



SEMESTER I- BRIDGE COURSE

ODD SEM

Programme	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

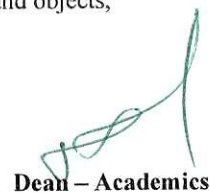
Pre – requisite - Nil

Unit	Description	Instructional Hours
	INTRODUCTION	
I	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
	ARRAYS AND POINTERS	
II	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
	EVOLUTION OF OOP LANGUAGES	
III	Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings- Function Overloading -Operator Overloading - Dynamic Memory Management	9
	CLASSES AND OBJECTS	
IV	Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator- Constants - Static Members - friend Function and friend Class.	9
	ADVANCED FEATURES	
V	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 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


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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
INTRODUCTION TO WWW		
I	Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.	9
UI DESIGN		
II	Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists	9
CASCADING STYLE SHEET (CSS)		
III	The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets	9
CASCADING STYLE SHEET (CSS)		
IV	Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.	9
SCRIPTING LANGUAGES		
V	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 Proficiency in concepts of World Wide Web, and the requirements of effective web des
- 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 simple to 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 <ul style="list-style-type: none"> • 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 and 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	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 5. Construct Project Scheduling Techniques using Pert and CPM.

Pre – requisite - Nil

Unit	Description	Instructional Hours
	PROBABILITY AND RANDOM VARIABLE	
I	Definition – Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem (with out proof) -Random variable –Discrete and continuous random variables – Moment generating functions.	12
	TESTING OF HYPOTHESES	
II	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
	LINEAR PROGRAMMING MODELS	
III	Mathematical Formulation of LPP- Graphical method– Simplex method – Artificial variable Techniques- Sensitivity analysis.	12
	TRANSPORTATION AND ASSIGNMENT MODELS	
IV	Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.	12
	SCHEDULING BY PERT AND CPM	
V	Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.	12
Total Instructional Hours		60

COURSE OUTCOME	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.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply probability concepts and analyze random variables in practical scenarios.	3	3	-	2	-	1	-	-	-	-	-	-
CO2	Proficiently conduct hypothesis tests using various distributions	3	3	2	3	3	1	-	-	-	-	-	-
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	1	-	-	-	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	1	-	-	-	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	1	-	-	-	2	-	-
	CO PO Mapping Average Value	3.0	3.0	2.0	2.2	3.0	1.0	-	-	-	2.0	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1231	UI DESIGN AND DEVELOPMENT	3	0	2	4
COURSE OBJECTIVE		<ol style="list-style-type: none"> To evaluate the foundational components and protocols of the World Wide Web and demonstrate a comprehension of its architecture and associated Internet standards. To implement HTML5 and CSS3 principles, utilize HTML5 APIs, SVG, Canvas, Audio & Video, Drag/Drop and master debugging and validation for enhanced user interfaces. To Articulate the foundational aspects of JavaScript, including core features, data types, functions, and DOM manipulation, enabling effective utilization in web development. To analyze JavaScript error handling and debugging, and to effectively use jQuery for web development. To apply object-oriented programming concepts in PHP and to effectively create and manage web databases using MySQL. 				

Pre-Requisite – 21CA1292 Fundamentals of Web Design

Unit	Description	Instructional Hours
I	<p>INTRODUCTION</p> <p>Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP Request – Response. Introduction HTML – HTML Elements – Semantics – Attributes –Headings- Paragraph-Styles – Formatting – Quotations – Computer Code- Comments & Colors- HTML CSS– Links & Images –Lists-Classes-Layout.</p> <p>Illustrative Problem: Develop a web page which includes various text formatting commands, Unordered list, ordered list, Table, simple form, hyper link, insert an image to Web page, insert scrolling text using Marquee tag, divide a page into Frames, simple layout of Webpage.</p> <p>UI DESIGN</p> <p>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.</p> <p>Cascading Style Sheet (CSS3): The Need for CSS – Basic Syntax and Structure - How to add CSS :Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning Using CSS -Responsive Web Design.</p>	8
II	<p>Illustrative Problem: Develop a Tribute page by Make webpage writing about that person adding his/her image. On the top of the webpage, add the image and name of the person and below that give layout for the rest of the details. You can use paragraphs, lists, links, images with CSS to give it a descent look. Add a suitable background color and font style on your webpage. Most of the parts you can make using HTML but to give it a better look using a bit of CSS. Take help from the link given below.</p> <p>OVERVIEW OF JAVASCRIPT</p> <p>Introduction - Objects- Scope – Data Types and Variables - Array, Date and Math Related Objects - Operators, Expressions, and Conditions, loop Statements – Type Conversion – Java Script Forms – Form Validations - Java Script HTML Document Object Model.</p>	4
III	<p>Illustrative Problem: Develop a random quote generator app that displays random famous quotes every time a button is pressed in this project. A quote from a prominent athlete, politician, or historical figure can be displayed.</p>	4
IV	<p>JAVASCRIPT ERROR HANDLING AND JQUERY</p> <p>JavaScript Errors – Debugging – JavaScript Functions. Introduction to jQuery – Syntax – Selectors –Events – Traversing – AJAX.</p>	8

	Illustrative Problem: Implement the project using AJAX and Jscript to create normal drop down box from which selecting an item will display its detail and information.	4
	PHP Introduction –Using Arrays – String Manipulations – Object Oriented PHP: Object Oriented Concepts – Creating Classes, Attributes, Operations in PHP – Implementing Inheritance in PHP. Creating Web Database: Creating database and users – Setting up user for web – Creating database Tables Inserting, retrieving and updating data into database – Altering tables. Accessing MySQL from web with PHP	7
V	Illustrative Problem: Implement a Login System with PHP and My SQL. Implement an interaceb application for online shopping with PHP.	5
	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: Develop the ability to implement JavaScript error handling and debugging techniques, utilizing jQuery to enhance web application interactivity and functionality.
	CO5: Develop the ability to design and implement object-oriented PHP applications and proficiently interact with MySQL databases for dynamic web development.

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, Brent Ware, “Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP” Addison Wesley, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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	1	2	-	2	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	1	2	-	-	2	-	-

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	1	2	-	1	1	-	-
CO4	Develop the ability to implement JavaScript error handling and debugging techniques, utilizing jQuery to enhance web application interactivity and functionality.	3	3	2	1	3	1	3	-	-	1	-	-
CO5	Develop the ability to design and implement object-oriented PHP applications and proficiently interact with MySQL databases for dynamic web development.	3	3	3	2	3	1	3	2	2	2	-	-
CO PO Mapping Average Value		3.0	3.0	2.2	1.2	3.0	1.0	2.4	2.0	1.7	1.4	-	-


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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

- To categorize network uses, communication models, and data transmission concepts to establish a foundational comprehension of network protocols, OSI, LAN topology, and transmission media.
- 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
- 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.
- 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.
- 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
NETWORK FUNDAMENTALS		
I	Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocols – OSI–LAN Topology - Transmission media.	9
DATA LINK LAYER		
II	Functions of Data link Layer - Flow Control Protocols – Error Detection – Parity check, Checksum & CRC - Error Correction - Hamming Code - Ethernet, Token ring, Wireless LAN.	9
NETWORK LAYER		
III	Switching concepts – Circuit switching – Packet switching –IPV4, IPV6 —IP address Hierarchy – ICMP – Routing Protocols – Distance Vector – Link State.	9
TRANSPORT LAYER		
IV	Functions of Transport Layer -, Connection Establishment, Connection Release, Flow Control – Sliding Window protocol, UDP, TCP, Congestion control and Avoidance.	9
REAL TIME APPLICATIONS& NETWORK SECURITY		
V	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.

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", Ninth 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	1	1	1	-	-	-	-	-
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	1	-	-	-	-	-
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	1	-	-	-	-	-
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	1	-	-	-	-	-
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	1	1	-	-	-	-
	CO PO Mapping Average Value	3.0	3.0	2.2	1.4	2.4	1.6	1.0	1.0	-	-	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1203R	JAVA PROGRAMMING	3	1	0	4

- Course Objective
1. Analyze the core concepts of Java programming to evaluate its capabilities for building applications.
 2. Apply advanced OOP concepts (inheritance, polymorphism, encapsulation) to design well-structured and reusable Java classes.
 3. Enhance program robustness and control concurrency through exception handling and multithreading techniques in Java.
 4. Develop interactive graphical user interfaces (GUIs) for Java applications using AWT controls and event-driven programming.
 5. Enhance Java application capabilities by integrating data access, management, and communication functionalities..


Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction –JDK Installation and Path Specification - Java Application Structure - Data types – Variables – Arrays –Operators - Control Structures– Class – Objects – Methods – Overloading Methods - Constructors – “This” keyword - Garbage Collection	12
	OOPS	
II	Nested classes – Inheritance – Using super keyword - Access specifier- Encapsulation- Interface-Polymorphism– Multi Level hierarchy – Method Overriding - Dynamic Method Dispatch – The Object class – Abstract classes -Package	12
	EXCEPTION HANDLING & THREADS	
III	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 – String Handling – Tokenizer - Wrappers	12
	AWT, FRAMES& APPLETS	
IV	AWT controls - Frames – Applet structure – HTML Applet Tag – Event Handling -Event Listeners - Applet Programming	12
	FILES & DATABASES	
V	Networking – RMI- I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Java Collections	12
Total Instructional Hours		60

- Course Outcome
- CO1: Create well-structured Java programs that demonstrate proficiency in data types, control flow, and object-oriented programming through hands-on exercises.
- CO2: Become proficient in crafting object-oriented solutions using nested classes, interfaces, abstract classes, and packages.
- CO3: Develop Java applications that gracefully handle errors and execute tasks concurrently using try-catch blocks, threads, synchronization, and string manipulation tools.
- CO4: : Create functional applets with user interaction using frames, event listeners, and proper HTML applet tags.
- CO5: Build feature-rich Java applications using I/O streams, collections, JDBC, and RMI for data access, management, and distributed computing.

REFERENCE BOOKS:

- R1- Herbert Schildt, "JAVA - The Complete Reference", Ninth Edition 2014, McGraw-Hill Education,
 R2- Rashmi Kanta 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	Create well-structured Java programs that demonstrate proficiency in data types, control flow, and object-oriented programming through hands-on exercises.	3	2	3	1	3	1	1	-	-	-	-	-
CO2	Become proficient in crafting object-oriented solutions using nested classes, interfaces, abstract classes, and packages.	3	3	3	1	3	1	1	3	-	-	-	-
CO3	Develop Java applications that gracefully handle errors and execute tasks concurrently using try-catch blocks, threads, synchronization, and string manipulation tools.	2	2	2	2	3	1	1	2	-	-	-	-
CO4	Create functional applets with user interaction using frames, event listeners, and proper HTML applet tags.	2	2	2	2	2	1	1	3	-	-	-	-
CO5	Build feature-rich Java applications using I/O streams, collections, JDBC, and RMI for data access, management, and distributed computing	2	2	2	2	3	1	1	2	-	-	-	-


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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
<ol style="list-style-type: none"> To employ database languages, and design database schemas, demonstrating proficiency in understanding and applying fundamental concepts of database architecture and data modeling. To Evaluate and apply advanced relational algebra and SQL concepts to optimize relational database querying. To Evaluate functional dependency and normalization principles for optimal relational database design. To Analyze transaction processing and concurrency control methods, developing proficiency in their implementation. 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	<p>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.</p>	9
II	<p>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.</p>	9
III	<p>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).</p>	9
IV	<p>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.</p>	9
V	<p>SPECIALITY DATABASES & NO SQL DATABASE Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance in SQL, Table Inheritance, Object-Identity and Reference Types in SQL.Unstructured database – NOSQL an Overview</p>	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)

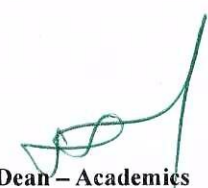
R2. Raghurama Krishnan, Johannes Gehrke-Data base Management Systems- McGraw-Hill Education, 3rd Edition, 2003.(Units 1,2,3)

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	-	-	-	-	-	-
CO2	Execute relational algebra operations, employ SQL queries (DDL and DML), analyze set operations, aggregate functions, and nested subqueries.	3	3	1	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	-	-	-
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	-	-	-
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	-	-
	CO PO Mapping Average Value	3.0	3.0	2.6	2.4	2.8	2.4	2.8	2.7	2.0	2.0	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1001R	JAVA PROGRAMMING LAB	0	0	3	1.5

- COURSE OBJECTIVE**
1. Deepen your understanding of OOP by building Python programs that leverage control structures, constructors, inheritance for reusability, and interfaces/packages for modularity in various functionalities.
 2. Practice advanced object-oriented programming concepts in Python by implementing polymorphism concepts, multithreading and exception handling.
 3. Extend your Python programming skills by implementing various functionalities using strings, files, streams, vectors, and network operations.
 4. Develop interactive graphical user interfaces (GUIs) using Java's AWT components and event handling.
 5. Implement database connectivity using any backend

Pre – requisite – Nil

Unit	Description	Instructional hours
	OBJECT, ARRAYS, CONTROL STRUCTURE AND CONSTRUCTOR	
1	<ol style="list-style-type: none"> a. Write a program to calculate employee payroll using arrays and structures. Create 2 classes to perform payroll calculation and for input and output display. Based on basic pay create array to calculate HRA, DA, MA, PF and net pay. b. Write a program for complex number operation using constructors 	3
	INHERITANCE	
2	Give an array of size N which contains the marks of a student in N subjects, the task is to calculate the CGPA of the student. Write a program for marksheet preparation using 3 classes to get, calculate and display mark statement using inheritance. Note: Consider all marks to be out of 100 for each subject.	3
	INTERFACE AND PACKAGE	
3	<ol style="list-style-type: none"> a. Create an interface for declaring variables and methods and create two classes for performing calculation and execution to find voter eligibility. b. Create a package for flat water maintenance bill, import the package in a class file to get input and display the final detailed bill. Note: Calculate water bill based on water consumption as given below: Rate (Rs/m³), Charges (Rs) Usage (m³), for 0 - 20 m³ -> Rs.0.50/-, for 21 - 35 m³->Rs.0.90/-, for > 35 m³->Rs.1.30/- 	3
	OVERLOADING, OVER-RIDING AND MULTITHREADING	
4	<ol style="list-style-type: none"> a. Write a program to calculate the area of square, rectangle and triangle. Create a method area, perform method over riding and overloading using the method area. b. Write a program to display 16 times tables up to 16 using multithreading 	3
	USER-DEFINED AND PRE-DEFINED EXCEPTION HANDLER	
5	<ol style="list-style-type: none"> a. A company consists of 1000 employees over 50 years. Each employee is assigned with unique id number up to 1000. Write a program to check the details of the employee using employee id. Generate user-defined exception handler if the employee id is not in the database. b. Create build-in exceptions using try and catch block. Arise exception in try block and handle the build-in exception in catch block. Execute the exception code in separate class to check arithmetic exception, array index out of bound exception, negative array size exception and number format exception. 	6
	STRING CLASS AND STRING TOKENIZER	
6	<ol style="list-style-type: none"> a. Get strings as input. Use switch statements to select the string functions like insert, append, delete, concatenate, find and replace. Read input and perform the actions using string buffer functions. 	6

	b. Get multiple statements as string input. Use full stop as String tokenizer. Using while loop count the tokens and display the string in separate line by sorting the string.	
	FILES AND STREAMS	
7	Assign a variable to receive the units of electricity consumed, the task is to calculate the electricity bill using Files and streams, provided 1 to 100 units – Rs.10/unit, 100 to 200 units – Rs.15/unit, 200 to 300 units – Rs.20/unit and above 300 units – Rs.25/unit.	3
	VECTOR AND WRAPPER CLASS	
8	A cone shaped tank is used to store water with 9 feet height and 14 feet diameter. Calculate the volume using vector and wrapper class by providing input values during run time, round off the values if needed and use pi=3.14. Formula to calculate volume is $v=1/3*\pi*r^2*h$	3
	NETWORKING OPERATION	
9	Create a client port, server port, buffer size and datagram socket. Connect both ports in two different command prompts and interchange text message between both the ports	3
	AWT CONTROLS	
10	Use applet viewer to get personal details using text box for receiving name, check box group for gender details, text box with scroll bar for address details, List for qualification details, Choice option for country details and button to submit details. Using ActionListener() add the details and print the details.	3
	APPLET & FRAMES	
11	a. Create a class mouse extend applet implementing MouseListener, MouseMotionListener. Override both methods using action commands performed by mouse events and print the mouse events like mouse pressed, released, clicked, dragged, moved, entered and exited. b. Create a class KeyEvent extend Applet implementing KeyListener. Override both method using action commands performed by key events and print keyboard events like pressed, released and typed. c. Create class using frame concept implementing WindowListener() and MouseListener()	6
	DATABASE	
12	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.	3
	Total Instructional hours	45

**COURSE
OUTCOME**

- CO1: Develop Java programs demonstrating object-oriented design with control flow, object initialization, inheritance relationships, interfaces, and modular packages for various tasks(p1,p2,p3)
- CO2: Develop object oriented programming code for implementing concepts of polymorphism, threading and exception handling.(p4,p5)
- CO3: Solidify your Java programming skills by building programs on strings, files, streams, vectors, and develop code for network operations
- CO4: Develop interactive java programs using AWT controls and Event Handling.
- CO5 : Design and implement a secure system for managing Aadhaar records using a relational database either oracle / SQL / MYSQL

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop Java programs demonstrating object-oriented design with control flow, object initialization, inheritance relationships, interfaces, and modular packages for various tasks	3	3	3	1	3	1	1	-	3	1	-	-
CO2	Develop object oriented programming code for implementing concepts of polymorphism, overloading and exception handling.	3	3	3	1	3	1	1	-	3	1	-	-
CO3	Solidify your Java programming skills by building programs on strings, files, streams, vectors, and develop code for network operations	3	3	3	1	3	1	1	-	2	1	-	-
CO4	Develop interactive java programs using AWT controls and Event Handling.	3	3	3	1	3	1	1	-	2	1	-	-
CO5	Design and implement a secure system for managing Aadhaar records using a relational database either oracle / SQL / MYSQL	3	3	3	1	3	1	1	-	3	1	-	-
	CO PO Mapping Average Value	3.0	3.0	3.0	1.0	3.0	1.0	1.0	-	2.6	1.0	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1002	DBMS 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.

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
5	Execute a DDL, DML, DCL and TCL commands for a Table	3
6	Execute SQL Functions	3
7	Execute various Joins and Sub Queries	3
8	Given an Scenario, Apply Normalization at all levels.	6
9	Write PL/SQL Procedure for an application using Exception Handling	3
10	Write PL/SQL Procedure for an application using Cursors.	3
11	Write a PL/SQL program for an application using Functions.	3
12	Write a PL/SQL block for transaction operations of a typical application using Triggers	3
13	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	1	3	1	1	1	3	-	-	1
CO2	Proficient in using SQL commands, functions, and advanced querying techniques to manipulate and retrieve data from relational databases.	3	3	3	1	3	1	1	1	2	-	-	1
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	1	3	1	1	1	2	-	-	1
CO4	Create applications using PL/SQL programming, with practical skills for building robust and efficient database applications.	3	3	3	1	3	1	1	1	-	-	-	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	1	3	1	1	1	-	-	-	1
	CO PO Mapping Average Value	3.0	3.0	3.0	1.0	3.0	1.0	1.0	1.0	2.3	-	-	1.0


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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. Understand Communication fundamentals and Principles
 2. Apply effective communication methods
 3. Evaluate and improve communication based on feedback.
 4. Ensure messages are understood correctly and clarify when needed.
 5. Engage in conversations, share messages, resolve issues, and report problems effectively.

Unit	Description	Instructional Hours
	DESCRIBE BASIC COMMUNICATION PRINCIPLES & PLAN FOR EFFECTIVE COMMUNICATION	
I	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
	PLAN FOR EFFECTIVE COMMUNICATION & APPLY BEST PRACTICES FOR CREATING BUSINESS DELIVERABLES	
II	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
	DELIVER YOUR MESSAGE	
III	Describe the variables involved in delivering an effective message - Identify methods of adapting a message based on audience feedback	9
	RECEIVE COMMUNICATIONS	
IV	Given a business communication, restate the key points of the –message - Given a message, identify appropriate responses or clarifying-questions	9
	ANALYZE COMMUNICATION SCENARIOS	
V	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	-	-	-	-	3	1	1	-	3	-	-	-

CO2	Apply the best communication method and use it effectively	-	-	-	-	3	1	1	-	3	-	-	-
CO3	Evaluate different methods of application of message and modify it according to the feedback received	-	-	-	-	3	1	1	-	3	-	-	-
CO4	Reiterate the received message and ensure that it has been received in the right context and explain it again wherever necessary	-	-	-	-	3	1	1	-	3	-	-	-
CO5	Participate effectively in formal or informal conversations, message sharing and resolving issues and complaints and reporting of the issues	-	-	-	-	3	1	1	-	3	-	-	-
	CO PO Mapping Average Value	-	-	-	-	3.0	1.0	1.0	-	3.0	-	-	-


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SEMESTER II - BRIDGE COURSE

EVEN SEM

Programme /Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2291	SOFTWARE ENGINEERING	3	0	0	-

COURSE OBJECTIVE	
	1. To provide an insight into the processes of software development
	2. To understand and practice the various fields such as analysis, design, development, testing of software Engineering.
	3. To develop skills to construct software of high quality with high quality with high reliability.
	4. To apply metrics and testing techniques to evaluate the software.
	5. To understand the system with various testing techniques and strategies

Pre -requisite – Nil

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Agile model - Prototype Model – Fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification.	9
	SOFTWARE DESIGN	
II	Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Designing for reuse – Programming standards	9
	SOFTWARE TESTING	
III	Software Testing Fundamentals – Software testing strategies – Black Box Testing – Whitebox Testing– System Testing– Object Orientation Testing – State based Testing– Testing Tools – Test Case Management	9
	MAINTENANCE	
IV	Software Maintenance Organization – Maintenance Report – Types of Maintenance- Software maintenance activities-Software reverse engineering	9
	SOFTWARE METRICS	
V	Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards	9
Total Instructional hours		45


COURSE OUTCOME	
	At the end of the course, the learner will be able to
	CO1: Get an insight into the processes of software development
	CO2: Able to understand the problem domain for developing SRS and various models of software engineering.
	CO3: Able to Model software projects into high level design using DFD, UML Diagram.
	CO4: Able to Measure the product and process performance using various metrics .
	CO5: Able to Evaluate the system with various testing techniques and strategies.

REFERENCE BOOKS:

- R1. Roger S. Pressman, "Software Engineering: A Practitioner Approach", Seventh edition, McGraw-Hill, 2010.
- R2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill Edition, 2008
- R3. Ali Behforrooz, Frederick J.Hudson, "Software Engineering Fundamentals", Oxford Indian Reprint, 2012
- R4. Sommerville, "Software Engineering", Sixth Edition, Addison Wesley-Longman, 2004.
- R5. Kassem A. Saleh, "Software Engineering", First Edition, J.Ross Publishing, 2009.
- R6. PankajJalote, "An Integrated approach to Software Engineering", Third Edition, Springer Verlag, 2005.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2292	OPERATING SYSTEMS	3	0	0	-

- 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 threads and deadlocks.
 4. To describe the concepts of Memory management with respect to Physical and Virtual Memory
 5. To Understand File Management, I/O Devices and various Disk Scheduling Strategies

Pre-requisite : Nil

Unit	Description	Instructional hours
	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	
I	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;	9
	PROCESS SYNCHRONIZATION,	
II	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, Dining Philosopher Problem Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery. .	9
	THREADS AND DEADLOCKS	
III	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	9
	MEMORY MANAGEMENT	
IV	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).	9
	FILE SYSTEMS MANAGEMENT, I/O AND DISK MANAGEMENT	
V	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), 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.	9
	Total Instructional hours	45

COURSE OUTCOME	At the end of the course, the learner will be able to 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. Understand Threads and Deadlock. CO4: Implement memory placement strategies, replacement algorithms related to main and virtual memory techniques CO5: Differentiate the file systems for applying various file allocation and access techniques, I/O and Disk Scheduling Strategies
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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. Dhamdhare, 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	21CA2091	SOFTWARE ENGINEERING TOOLS LAB	0	0	3	-

- Course Objective
1. To understand the basic concepts of software engineering, life cycle models and project management concepts
 2. To understand in detail about the requirement analysis and requirement engineering processes.
 3. To understand the concepts and principles involved in software design.
 4. To understand the concepts and various types of software testing and project implementation techniques.
 5. To understand the techniques involved in software project management and Risk management.

Pre-requisite : Nil


S.No	Description Of The Experiments	
1	Develop requirements specification for a given problem.	
2	Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.	
3	Develop Structured design for the DFD model developed.	
4	Develop UML Use case model for a problem.	
5	Develop sequence diagram.	45
6	Develop Class diagrams	

For the Following Scenario


- Passport automation System
- Online Exam Registration
- E-ticketing
- Recruitment system

Total Instructional hours 45

Course Outcome
 At the end of the course, the learner will be able to
 CO1: Ability to identify the minimum requirements for the development of application.
 CO2: Ability to develop, maintain, efficient, reliable and cost-effective software solutions.
 CO3: Ability to critically thinking and evaluate assumptions and arguments.


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SEMESTER II – REGULAR COURSES

Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2201R	DATA STRUCTURES AND ALGORITHMS	3	1	0	4

- COURSE OBJECTIVE**
1. To Analyze the concept of Dynamic memory management, data types, algorithms, Big O notation.
 2. To apply basic data structures such as arrays, linked lists, stacks and queues.
 3. To experiment and solve problems involving graphs, trees and heaps.
 4. To apply algorithms for solving problems like sorting, searching, insertion and deletion of data
 5. To experiment the hash functions and concepts of collision and its resolution methods.

Pre-requisite – 21CA1291 PoP and OOPs

Unit	Description	Instructional hours
	INTRODUCTION TO DS & ALGORITHM	
I	Data Structure – Algorithm – Dynamic Memory Management - Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notations (Big O, Omega, Theta)	12
	LINEAR DATA STRUCTURES	
II	Stack :Definition Operation, Uses, Implementation etc., Queue : Definition, Operations, Uses, Implementation, Types of Queue etc., Linked List: Definition, Operation, Uses, Implementation, Types (Singly, Doubly, Circular)	12
	NON-LINEAR DATA STRUCTURES	
III	Trees : Definition, Types of Trees, Operations of tree DS, Working etc., Binary Tree: Definition, Operations (Insertion, Deletion) AVL Tree: Definition, Operations, rotation etc M way tree, B Tree, B* Tree etc Graph – Definition, Types, Operations, Traversal, algorithms etc	12
	SORTING AND SEARCHING ALGORITHMS	
IV	Bubble sort, insertion sort, radix sort, quick sort, merge sort, shell sort etc Linear Search, binary search	12
	HASHING & ALGORITHM ANALYSIS	
V	Different hashing techniques, address calculation techniques, common hashing functions, Collision resolution, rehashing Dynamic Programming : Traveling Salesperson Problem (TSP), Backtracking: The 8 – Queens Problem, Branch and Bound: TSP	12
	Total Instructional hours	60

- COURSE OUTCOME**
- CO1: Analyze the concept of Dynamic memory management, data types, algorithms, Big O notation.
- CO2: Apply basic data structures such as arrays, linked lists, stacks and queues.
- CO3: Experiment and Solve problem involving graphs, trees and heaps.
- CO4: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data
- CO5: Experiment the hash function and concepts of collision and its resolution methods


REFERENCE BOOKS :

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed- Fundamentals of Data Structures in C – Second Edition- University Press India Pvt Ltd, Hyderabad- 2017.
2. Yashavant Kanetkar- Data Structures through C- Second Edition- BPB Publications, India- 2009.
3. S. K. Srivastava & Deepali Srivastava-Data Structures through C in Depth-Second Revised & Updated Edition-BPB Publications, New Delhi- 2011
4. A. Puntambekar- Data Structures and Algorithms- Second Revised Edition- Technical Publications, Pune- 2020.
5. (For Problems) Seymour Lipschutz- Data Structures with C- Schaum's Outlines- Special Indian Edition- Tata McGraw-Hill Education (India) Pvt Ltd, Chennai- 20th reprint 2017.
6. Advanced Algorithms and Data Structures, Marcello La Rocca, Manning Publications, 2021
7. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition (Benjamin Baka, 2018) Kindle Edition.
8. Data Structures and Algorithms in Java, Robert Lafore · 2017, SAMS Publication

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Analyze the concept of Dynamic memory management, data types, algorithms, Big O notation.	3	3	3	1	1	1	3	-	-	-	-	-
CO2	Apply basic data structures such as arrays, linked lists, stacks and queues.	3	3	3	1	1	1	2	-	-	-	-	-
CO3	Experiment and Solve problem involving graphs, trees and heaps.	3	3	3	1	1	1	2	1	-	2	-	-
CO4	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	3	3	3	1	1	1	3	1	-	2	-	-
CO5	Experiment the hash function and concepts of collision and its resolution methods	3	3	3	1	1	1	3	1	-	2	-	-
	CO PO Mapping Average Value	3.0	3.0	3.0	1.0	1.0	1.0	2.6	1.0	-	2.0	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2203R	PYTHON PROGRAMMING	3	1	0	4

COURSE OBJECTIVE

- Gain foundational knowledge of Python programming to create simple applications.
- Leverage Python's diverse data structures (lists, tuples, sets, dictionaries, strings, regular expressions) and explore modular code organization with modules and packages.
- Empower your programs to interact with files, handle errors gracefully, and create custom exceptions for robust functionality.
- Delve into object-oriented principles (classes, objects, inheritance, polymorphism) for creating reusable and maintainable Python code.
- Explore the fundamentals of web application development in Python, including structure, templating, forms, database interaction, and web scraping.

Pre-requisite – 21CA1291 PoP and OOPs

Unit	Description	Instructional Hours
I	Basics of Python 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 – Function Call and Returning Values	12
II	Data Types in Python Lists – Tuples – Set – Dictionaries – Strings – Regular Expressions Modules: Module Loading and Execution–Packages–Making Your Own Module–Python Standard Libraries	12
III	File Handling and Exception Handling Files: Introduction – File Path–Opening and Closing Files, Reading and Writing, Pickle and Unpickle, Exception handling – Assertions and Logging – Create User Defined Exceptions.	12
IV	Object Oriented Programming Classes and Objects – Constructors –Destructors –Getter and Setter Methods – Encapsulation – Inheritance – Polymorphism – Abstract classes and Interfaces	12
V	Web Operations in Python Basic Web Application Structure –Templates – Web Forms – Databases – Web Scrapping in Python	12
Total Instructional Hours		60


COURSE OUTCOME

- Design Python programs that effectively utilize data structures, control flow, functions, and object-oriented principles for basic tasks.
- Develop Python programs that efficiently store, manipulate, and organize data using these structures, while promoting code reusability through modules and packages.
- Build Python applications that can read from, write to, and manage files while ensuring program stability through exception handling.
- Design and develop object-oriented Python programs with well-defined classes, data encapsulation, and inheritance hierarchies
- Build basic web applications in Python that can interact with databases, handle user input, and potentially scrape data from website.


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 Object-Oriented Python: Master OOP by Bu Paperback – Import, 25 January 2022, No Starch Press, US
 R4 - Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, 2nd edition No Starch Press, 2019
 R5 - Arun Ravindran, Samuel Dazon 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	Design Python programs that effectively utilize data structures, control flow, functions, and object-oriented principles for basic tasks.	3	3	3	2	3	1	3	2	-	-	-	-
CO2	Develop Python programs that efficiently store, manipulate, and organize data using these structures, while promoting code reusability through modules and packages.	3	3	3	2	3	1	2	2	-	-	-	-
CO3	Build Python applications that can read from, write to, and manage files while ensuring program stability through exception handling.	3	3	3	2	3	1	2	2	-	-	-	-
CO4	Design and develop object-oriented Python programs with well-defined classes, data encapsulation, and inheritance hierarchies	3	3	3	2	3	1	3	2	-	-	-	1
CO5	Build basic web applications in Python that can interact with databases, handle user input, and potentially scrape data from website	3	3	3	2	3	1	3	2	-	-	-	1
	CO PO Mapping Average Value	3.0	3.0	3.0	2.0	3.0	1.0	2.6	2.0	-	-	-	1.0


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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2251	WEB DEVELOPMENT	3	1	0	4

- COURSE OBJECTIVE**
1. To make use of basics of JavaScript and importance of MERN stack
 2. To develop API with Express Framework.
 3. To design the front-end components using React.
 4. To design and develop backend components using Node.js
 5. To model a database system using MongoDB.

Pre – requisite – 21CA1201 UI Design and Development

Unit	Description	Instructional hours
	JAVASCRIPT AND BASICS OF MERN STACK	
I	Javascript Fundamentals - Objects - Generators, Advanced Iteration - Modules - CSS, SCSS and Bootstrap - Dom Tree - Node Properties - Browser Events - Event Delegation - UI Events -Forms, Controls - Document and Resource Loading - Mutation Observer - Event Loop: Microtasks and Macrotasks - Mern Components - React - Node.Js - Express - Mongoddb - Need for Mern - Server-Less Hello World - Server Setup - NVM - Node.Js - Npm. <i>Program</i> i. <i>Simple programs in MERN environment</i> ii. <i>Programming exercise on JavaScript basic and advanced features</i>	12
II	EXPRESS JS Express - Restful Services - Introducing Express - Building Your First Web Server - Nodemon - Environment Variables - Route Parameters - Handling Http Get Request - Handling Http Post Request - Calling Endpoints Using Postman - Input Validations - Handling Http Put Request - Handling Http Delete Request	12
III	REACTJS Introduction To React – Installation –Introduction To Jsx – Rendering Jsx Elements – Jsx Expressions – Jsx Attributes – Jsx Comments – Jsx Styling – Creating Components – Managing State – Using Props – Nested Components – Life Cycle Methods- Functional Components-Creating React Application – Constructors – Forms – Events – List – Keys – Refs – Fragments – Router – Css – Using Javascript Objects - Animations – Css Transition – React Hooks – Bootstrap – Installation - Map – Table– Higher Order Components – Flux - Redux Fundamentals – Redux Store – Redux Reducers – Redux Components <i>Program</i> iii. <i>REACT based programming</i> iv. <i>Exploring stateless components</i> v. <i>Designing components with React CSS and SaaS</i>	12
IV	NODEJS Introduction – Installation – Console – Repl Commands – Package Manager – Command Line Options – Functions - Global Objects – Timer – Error Handling – Dns – Callbacks – Events – Web Module – Node.js Mysql - RESTful API. <i>Program</i> vi. <i>Node and Express based web development Handling of various APIs associated with Node.js</i>	12
V	NODEJS WITH MYSQL AND MONGODB Create Connection with Mysql - Mysql Create Database - JsMysql Create Table - Insert Records - Update Records - Delete Records - Select Records - Drop Table. Create Connection with Mongoddb – Installation – Introduction to Mongoddb (No-Sql) - Collections in Mongoddb - Documents in Mongoddb - Difference Between MysqlandNosql Create Database - Insert Record - Select Record - Filter Query – Sorting – Remove	12

Program

- vii. *Data manipulation exercises (CRUD)*
- viii. *Querying the MongoDB databases*
- ix. *Exploring Aggregation, Replication, Sharding and other features in MongoDB*

Total Instructional hours 60

COURSE OUTCOME

CO1: Construct client-side scripting using JS and MERN stack.
 CO2: Design applications using Express Framework.
 CO3: Build web applications using REACT.
 CO4: Implement Web Application using NodeJS.
 CO5: Construct database connectivity in Node.js.

Reference

- R1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasana Subramanian, A Press Publisher, 2019.
- R2 :JobineshPurushothaman, “Restful Java Web Services”, Second Edition, Packt Publishing, 2015.
- R3: Robin Wieruch – “The road to react, your journey to master plain yet pragmatic React “, 2016.
- R4 : Cory Gackenheimer, “ Introduction to React” – Published by Apress- 2015.
- R5. Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020
- R6. Marc Wandschneider, “Learning Node”, Addison-Wesley Professional, 2nd Edition, 2016
- R7. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node,Vasana Subramanian, A Press Publisher, 2019

Web Reference

- <http://tutorialsteacher.com>
- <https://reactjs.org/>
- <https://nodejs.org>
- www.Expressjs.com
- www.mongodb.com

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Construct client-side scripting using JS and MERN stack.	3	3	3	1	3	1	3	2	-	1	-	-
CO2	Design applications using Express Framework.	3	2	3	1	2	1	3	2	-	1	-	-
CO3	Build web applications using REACT.	3	3	3	1	2	1	3	2	-	1	-	-
CO4	Implement Web Application using NodeJS..	3	3	3	1	2	1	3	2	1	1	-	-
CO5	Construct database connectivity in Node.js.	3	3	3	1	2	2	3	2	1	1	-	-
	CO PO Mapping Average Value	3.0	2.8	3.0	1.0	2.2	1.2	3.0	2.0	1.0	1.0	-	-

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21EC2251	ELECTRONICS FOR EMBEDDED SYSTEMS	3	0	0	3

- Course Objective
1. To learn the fundamentals of basic electronic devices
 2. To teach the digital system design
 3. To study the instruction sets and operations of 8051 Microcontroller
 4. To impart knowledge on basics of embedded systems
 5. To provide insight on embedded system design for IoT.

Unit	Description	Instructional Hours
	BASIC ELECTRONIC DEVICES	
I	PN Junction Diode - Zener Diode –BJT: Types, CE-Configuration, Operation & Characteristics, JFET – Construction& Working Principle – Types: E-MOSFET,D-MOSFET – Op-amp and its Basic Applications.	6
	DIGITAL FUNDAMENTALS	
II	Digital Systems –Logic Gates – Boolean Algebra – K-Maps–NAND, NOR Implementation- Adders, Subtractors, Flip Flops – JK and D Flip flop, Shift Registers and Up-Down Counters	6
	8051 MICROCONTROLLER	
III	Microprocessor and Microcontroller – 8051: Architecture - Timer – Interrupts - Addressing Modes – Instruction Set – Assembly Language Programming Language Programming.	6
	EMBEDDED SYSTEMS	
IV	Introduction to Embedded Systems – Classification –Applications: Temperature Sensor Interfacing, Traffic Light Control – General Purpose and Domain Specific Processors – ADC&DAC Interfacing	6
	APPLICATION OF EMBEDDED SYSTEMS AND IoT	
V	Classification of Sensors and Actuators - Input and Output Characteristics - Sensors and Actuators- Introduction to IoT- Home Automation using IoT	6
	Total Instructional Hours	30

Lab Module

1. VI Characteristics of PN Junction Diode
2. Characteristics of CE Transistor
3. Characteristics of FET
4. RC or Wein Bridge Oscillator
5. Study of Logic Gates(Basic Gates)
6. Half Adder and Full Adder
7. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non-Inverting)
8. 8bit Addition, Subtraction

- 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

REFERENCEBOOKS:

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, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “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.MorrisMano,“Digital Logic and Computer Design”, Pearson Education, 2008.

	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	1	2	1	2	-	-	-	-	-
CO2	Apply the Embedded C Programming and RTOS Concepts to various applications.	3	3	3	1	3	1	2	-	-	-	-	-
CO3	Create and test assembly level programming for ARM Processors	3	3	3	1	2	1	2	-	-	-	-	-
CO4	Explain various interfacing techniques using microcontroller.	3	3	3	1	3	1	3	-	-	-	-	-
CO5	Describe the development and applications of sensors and actuators	3	3	3	1	3	1	3	-	-	-	-	-
	CO PO Mapping Average Value	3.0	3.0	3.0	1.0	2.6	1.0	2.4	-	-	-	-	-


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
MCA/ II	21CA2001	PYTHON PROGRAMMING LAB	0	0	3	1.5
COURSE OBJECTIVE		1. To develop Python programs using control and looping Structures. 2. To develop Python programs using various data structures, Strings, Functions, Regular Expressions and Packages. 3. To develop programs using File Handling and Exception Handling. 4. To develop programs using Object Oriented Programming Concepts. 5. To implement the programs using web operations in python.				

Pre-requisite – 21CA1091 PoP and OOPs Lab

S.no	Description of the experiments	practical hours
	Module 1: Programs on basics of python	
1	1. Install anaconda, pycharm and Jupiter. 2. Use format() method to display the user given input. 3. Implement password validation using conditional checking and branching. 4. Predict the future tuition fees for a university using conditional checking and looping. 5. Implement python calculator using conditional checking with break and continue statement. 6. Implement movie ticket booking management system in python using functions and returning values.	9
	Module 2: Programs on data types in python	
2	1. Create a list with 10 elements a. Slice first element. b. Slice last element. c. Slice 3 rd to 7 th element. d. Index the list. e. Add one element to list. f. Add several elements to list. 2. Create two list a. Combine two list b. Repeat the list for given number of times. c. Remove an element from the list. d. Empty the list. 3. Create a tuple named as TUPLE1 with the following items in the Tuple. i. TUPLE1 = ('tupleexample', False, 3.2, 1) ii. TUPLE2 = tuplex = ("p", "y", "t", "h", "o", "n", "c", "o", "d", "e") a. Display the TUPLE 1, TUPLE2 b. Display the 4 th Item from the TUPLE2 c. Display the 4 th Item from TUPLE2 using Negative Indexing. d. Check whether the element 3.2 exist in TUPLE1. e. Convert the List1 = [1,2,3,4,5,6] to a TUPLE. f. Unpack the TUPLE3 = 4,8,3 into Several variables. g. Count the frequency of the Item "o" from TUPLE2. h. Display the length of the TUPLE2. i. Reverse the TUPLE2. 3. Create a dictionary a. Get a list of all keys. b. Get a list of all values. c. Slice a dictionary. d. Remove an element from dictionary. e. Clear the dictionary. 4. Do membership test and iterate over the list. 5. Get string input from user. In that string a. Check for a phrase or a character b. Check for duplicated words. If there is a duplicate word counts on it. c. Do string strip and string replace operation? 6. Create a module, import it and execute in python.	9
3	Module 3:	9

Programs on File handling and Exception handling

1. Implement file concept in python. In a File do the following file operations:
 - a. Open a file and read its content.
 - b. Open a file and write its content to another file.
 - c. Open a file and append its content.
2. Implement Pickle and unpickle in python.
3. Implement Exception handling in python.
4. Do python code for assertions and logging.
5. Implement custom exceptions.

Module 4:

Programs on Object Oriented Programming.

- | | | |
|---|--|---|
| 4 | <ol style="list-style-type: none"> 1. Implement constructor and destructors in python. 2. Use getter and setter method in your program to get and set values from user. 3. Implement inheritance in python. 4. Implement polymorphism in python. | 9 |
|---|--|---|
- Implement abstract class and interface in python.

Module 5:

Programs on web operations in python.

- | | | |
|---|---|---|
| 5 | <ol style="list-style-type: none"> 1. Develop a web application using web forms. 2. Implement the python program to perform various database operations. 3. Implement web scrapping. | 9 |
|---|---|---|

Total Instructional hours 45

COURSE
OUTCOME

- CO1: Ability to develop python programs using control and looping structures
 CO2: Ability to develop simple applications using various data structures, Strings, functions, Regular Expressions and Packages.
 CO3: Ability to develop File Handling and Exceptional Handling programs in python.
 CO4: Able to develop python program using Object Oriented Programming Concepts.
 CO5: Able to implement the programs using web operations in python.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Ability to develop python programs using control and looping structures	3	3	3	2	2	-	2	-	-	-	-	2
CO2	Ability to develop simple applications using various data structures, Strings, functions, Regular Expressions and Packages.	3	3	3	2	3	-	2	-	2	-	-	2
CO3	Ability to develop File Handling and Exceptional Handling programs in python.	3	3	3	2	2	-	2	-	2	-	-	3
CO4	Able to develop python program using Object Oriented Programming Concepts.	3	3	3	2	3	2	2	-	2	1	-	3
CO5	Able to implement the programs using web operations in python.	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/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2002	DATA STRUCTURES AND ALGORITHMS LAB	0	0	3	1.5

- COURSE OBJECTIVE**
- Equip students with the foundational knowledge and practical skills to solve problems using computer programming techniques in C.
 - Gain practical experience core linear data structures (arrays, stacks, linked lists) in C programming.
 - Gain practical knowledge of Non Linear data structures in C
 - To analyze the concepts about searching and sorting algorithms.
 - To apply various programming constructs such as divide-and-conquer, backtracking, and dynamic programming..

Pre-requisite – 21CA1091 PoP and OOPs Lab

S. No	Program	Hours
	Exercise programs on Algorithm and Linear Data structures	
1.	a. Design an algorithm with the help of the following pre-requisites: problem, constraints, input, output, solution to the problem. Algorithm to add 3 numbers and print their sum. And write a program to add 3 numbers and print their sum.	9
2.	b. Demonstrate the dynamic memory allocation for a structure that asks the user to store the value of number of records and allocates the memory for the number of records structure variables dynamically using the malloc() function. a. Implement stack operations using Array. b. Implement queue operations using Linked list. c. Applications of stack data structure - to solve towers of Hanoi problem. d. Perform the following operations on a single and doubly linked list i. Creation of a linked list ii. Traversing a linked list iii. Searching an element iv. Insert an element v. Deletion of an element vi. Reversal of a linked list. e. Applications of list – Polynomial manipulation representations.	9
	Exercise programs on Nonlinear data structures	
3	a. Implementation of Binary Trees such as i. Creation ii. Insertion iii. Search iv. Delete. b. Implement traversals of Binary Trees. i. Inorder ii. Preorder iii. Post order. c. Implementation of AVL Trees. i. Creation ii. Insertion iii. Search iv. Delete. d. Implement traversals of AVL Trees. i. Inorder ii. Preorder iii. Post order. e. Implementation of M way Tress and perform the kinds of operations that are performed: i. Insertion of a new node. ii. Deletion of a node. iii. Deleting a node from the Right sub tree. f. Declare a queue and insert the starting vertex. Initialize a visited array and mark the starting vertex as visited. Implement Breadth First Search on graph. g. Create a recursive function that takes the index of the node and a visited array. Make the current node as visited and print the node. Traverse all the adjacent and unmarked nodes and call the recursive function with the index of the adjacent node. Implement a code using Depth First Search on Graph.	9

Exercise programs on Sorting and searching algorithms

- 4 a. Perform the following searching operations that use non recursive functions for a key value in a given list of integers: 9
- i. Linear search ii. Binary search
- b. Implements the following sorting
- i. Bubble sort ii. Radix sort iii. Quick sort
- iv. Insertion sort v. Merge sort vi. Shell sort

Exercise programs on Hashing and Algorithm Analysis

- 5 a. Given a set of cities and the distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. Implement and solve the Travelling salesperson problem using branch and bound.
- b. Demonstrate a program to insert a value into the hash table and search a value using linear probing.
- c. Demonstrate a program to insert a value into the hash table and search a value using quadratic probing. 9
- d. Demonstrate a program to insert a value into the hash table and search a value using double hashing.
- e. The problem of placing eight queens on an 8×8 chessboard such that none of them attack one another (no two are in the same row, column, or diagonal). Solve 8 queen’s problem using backtracking method.

Total Instructional hours 45

**COURSE
OUTCOME**

- CO1: Design basic algorithms to solve computational problems
 CO2 Develop programming skills by building and manipulating fundamental linear data structures (arrays, stacks, linked lists) to achieve various functionalities.
 CO3 Develop C programs that utilizes non linear data structures through various operations and traversal techniques.
 CO4 : Implement programs using various sorting and searching techniques
 CO5: Implement advanced algorithms (branch & bound, hashing, backtracking) in C to solve complex problems (TSP, hash tables, N-Queens) and improve problem-solving skills through analysis.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design basic algorithms to solve computational problems	3	3	3	-	3	-	1	-	1	-	-	-
CO2	Develop programming skills by building and manipulating fundamental linear data structures (arrays, stacks, linked lists) to achieve various functionalities.	3	3	3	1	3	-	3	-	-	-	-	-
CO3	Develop C programs that utilizes non linear data structures through various operations and traversal techniques.	3	3	3	1	2	-	2	-	-	-	-	-
CO4	Implement programs using various sorting and searching techniques	3	3	3	2	2	-	2	-	-	-	-	-

CO5	Implement advanced algorithms (branch & bound, hashing, backtracking) in C to solve complex problems (TSP, hash tables, N-Queens) and improve problem-solving skills through analysis.	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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PROFESSIONAL ELECTIVE

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
	DISK FORENSICS	
I	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
	SOFTWARE FORENSICS	
II	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
	NETWORK FORENSICS	
III	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
	CYBER SECURITY INTRODUCTION	
IV	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
	SECURITY INVESTIGATION AND ANALYSIS	
V	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
FUNDAMENTALS		
I	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
GREEN ASSETS AND MODELING		
II	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
GRID FRAMEWORK		
III	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
GREEN COMPLIANCE		
IV	Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	9
CASE STUDIES		
V	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		
COURSE OUTCOME	CO1: Apply knowledge to adopt green computing practices in different scenarios.	45
	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	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2
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
	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/ e-commerce/ 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
	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
I		
	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
II		
	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
III		
	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
IV		
	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
V		
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
	INTRODUCTION	
I	HTML coding - Basic web graphics - Web page design and site building - Image maps - Adding multimedia to the web- Vector and Raster graphics.	9
	RASTER IMAGE EDITING SOFTWARE	
II	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
	VECTOR IMAGE HANDLING	
III	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
	MULTIMEDIA	
IV	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
	APPLICATIONS	
V	Creating web site with a particular theme using all the utilities - Graphics - Animations and Interaction.	9
	Total Instructional Hours	45
	CO1: Recall the fundamental concepts of HTML for creating simple websites.	
	CO2: Utilize image editing software tools to design web pages effectively.	
COURSE OUTCOME	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.	

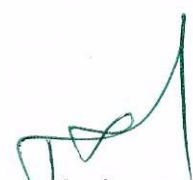
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1. Jon Duckett, HTML & CSS design and Build Web Sites John Wiley & Sons, 2011.
2. Andrew Rapo, Alex Michael, "Understanding Macromedia Flash 8 ActionScript 2: Basic Techniques for Creatives," Focal press Taylor and Francis group, 2013
3. Andrew Faulkner, Conrad Chavez Adobe 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
DIGITAL FUNDAMENTALS		
I	Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.	9
COMBINATIONAL AND SEQUENTIAL CIRCUITS		
II	Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters	9
COMPUTER FUNDAMENTALS		
III	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
PROCESSOR		
IV	Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
MEMORY AND I/O		
V	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, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "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
	INTRODUCTION	
I	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
	DESIGNING E-LEARNING COURSE CONTENT	
II	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
	CREATING INTERACTIVE CONTENT	
III	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
	LEARNING PLATFORMS	
IV	Types of Learning Platforms–Proprietary Vs. Open –Source LMS – LMS Vs LCMS– Internally Handled and Hosted LMS –LMS Solutions – Functional Areas of LMS.	9
	COURSE DELIVERY AND EVALUATION	
V	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

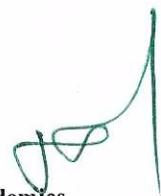
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- R1. Clark, R.C. and Mayer, R.E, “e-Learning and the Science of Instruction”, Third Edition, JohnWiley,2016.
 R2. Means, B., Toyama, Y., and Murphy, R, “Evaluation of Evidence – Based Practices in Online Learning: A Meta– Analysis and Review of Online 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. Imran Bashir, "Mastering Block chain: Distributed Ledger Technology Decentralization and Smart Contracts Explained", 2nd, Edition, Packt Publishing, 2018.
- R2. Arshdeep Bahga, Vijay Madiseti, "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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2
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	21CA2309	Introduction to Machine Learning	3	0	0	3
Course Objective	<ol style="list-style-type: none"> 1. Gain a Historical perspective of Machine Learning and become familiar with End to End Process of ML and ML Packages 2. Gain knowledge to experiment with Regression Algorithms. 3. Gain knowledge to experiment with Classification Algorithms. 4. To have a deeper insight on Unsupervised Learning Algorithms 5. Exploring more on Tuning parameters in ML 					


Unit	Description	Instructional Hours
I	Introduction Machine Learning: Introduction – History – Applications – Life Cycle – AI vs ML. Dataset: Types – Need – sources of ML datasets – Types of Machine Learning, Supervised, Unsupervised and Reinforcement Learning - End to End process of ML with a Case Study	9
II	Regression Regression Analysis – Terminologies – Types: Simple Linear Regression, Multiple Linear Regression - Polynomial Regression – Gradient Boost , XGBoost - Decision Tree Regression – Random Forest Regression - Jupyter notebook + Anaconda/Google Colab, Numpy, Pandas, Sci-kit Learn, Matplotlib and Seaborn	9
III	Classification Classification Types – Binary and Multiclass Classification - Logistic Regression - Support Vector Machines - Decision Tree Classification - Random Forest Classification - visualizing the decision boundaries – XG Boost Classification	9
IV	Unsupervised Learning Need for unsupervised Learning - K-means clustering- k-medoids - Hierarchical clustering – Anomaly Detection.	9
V	ML Principles Overfitting – Under fitting – data leaking - Principal Component Analysis – Cross Validation – P-value – hypothesis	9
Total Instructional Hours		45
Course Outcome	<ol style="list-style-type: none"> 1. To have insight into types of ML algorithms and build applications by applying various Data analysis tools and ML Packages. 2. To develop applications using various Regression Algorithms. 3. To develop Applications using Various Classification Algorithms. 4. To Identify and develop applications using Unsupervised learning Algorithms 5. To develop insights on tuning and hyper parameters in ML. 	

REFERENCE BOOKS:

1. Frank Pane, "Hands On Data Science and Python Machine Learning", Packt Publishers, 2017.
2. Bharti Motwani, "Data Analytics using Python", Wiley Publishing 2020
3. Ethem Alpaydin, —Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series) I, Third Edition, MIT Press, 2014
4. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Revised Edition, Springer, 2016.

6. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow", 2nd Edition, O'Reilly, 2019
7. Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
8. Tom M. Mitchell, "Machine Learning", India Edition, 1st Edition, McGraw-Hill Education Private Limited, 2013

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To have insight into types of ML algorithms and build applications by applying various Data analysis tools and ML Packages.	3	3	3	3	2	1	2	-	1	-	1	-
CO2	To develop applications using various Regression Algorithms.	3	3	3	1	3	1	2	2	1	-	1	-
CO3	To develop Applications using Various Classification Algorithms.	3	3	3	3	2	1	2	2	1	2	2	3
CO4	To Identify and develop applications using Unsupervised learning Algorithms	3	3	3	2	3	1	3	2	1	2	1	2
CO5	To develop insights on tuning and hyper parameters in ML.	3	3	3	2	3	1	3	-	1	2	1	3
	CO PO Mapping Average Value	3.0	3.0	3.0	2.2	2.6	1.0	2.4	2.0	1.0	2.0	1.2	2.7


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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	<p>J2EE PLATFORM Introduction -Enterprise Architecture Styles -J2EE Architecture - Containers - J2EE Technologies: Servlet, JSP, ETB and Types, JDBC,JMS,JTA, Java Mail, JNDI and JCA.</p> <p>SERVLETS Overview – architecture – life cycle – Interface – Generic Servlet – Http Servlet - filter – session – cookies – hidden form field – URL Rewriting – Http Session – Session login and logout.</p>	12
II	<p>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.</p>	12
III	<p>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</p>	12
IV	<p>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.</p>	12
V	<p>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</p>	12
Total Instructional Hours		60
COURSE OUTCOME	<p>CO1: Designing and implementing dynamic web applications using Servlets</p> <p>CO2: Develop dynamic web pages using JSP.</p> <p>CO3: Develop skills in building web applications using Spring MVC, including handling form submissions, file uploads, and pagination.</p> <p>CO4: Create interactive and dynamic user interfaces using React.</p> <p>CO5: Create Server side scripting using Node JS and perform database connectivity operations.</p>	

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- R1: Iuliana Cosmina , Rob Harrop ,Chris Schaefer ,Clarence Ho “Pro Spring 5 -An In-Depth Guide to the Spring-Framework 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 Gackheimer “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.
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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
	<i>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</i>	4
	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
II	<i>Illustrative Problems</i> <i>Use the income dataset was extracted from 1994 U.S. Census database and perform Data Fetching, Data Cleaning, Feature Engineering, Exploratory data Analysis</i>	6
	Machine Learning Machine Learning – Types of ML – Unsupervised Algorithms – Dimensionality Reduction , Clustering – Supervised Algorithms – Classification , Regression <i>Case Study on Supervised Learning, Un Supervised Learning</i>	6
III	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 <i>Apply Bayesian and SVM techniques on Diabetes Data Set</i> <i>Case Study on Data Distribution in HBase and MongoDB</i>	6
	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. <i>Implement a Map reduce program for a weather Data set</i>	6
IV	<i>Find Average, max, min temperature for each year in National Climate data centre data set</i> <i>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.</i>	6
	<i>HBase Installation and Operations on HBase</i>	
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 Madiseti, “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.

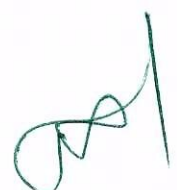
REFERENCES:

- 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 MySQL and 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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SEMESTER -IV

Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA4901	PROJECT WORK	0	0	0	14
COURSE OBJECTIVE		<ol style="list-style-type: none"> 1. Develop and assess students' abilities in applying analytical skills in solving real-world problems within the project context. 2. Develop proficiency in synthesizing clear and comprehensive project documentation, including plans, reports, and specifications. 3. Encourage the implementation of creative and innovative solutions to address project challenges and requirements. 4. Foster the ability to critically evaluate project success by considering key performance indicators and stakeholder satisfaction. 5. Cultivate effective team collaboration skills, emphasizing communication, shared goals, and successful team outcomes. 				

Pre-requisite – Nil

Sl. No.	Description of the Experiments
1.	Students should conduct an extensive review of relevant literature related to the project topic and summarize key findings, methodologies, and gaps in existing research.
2.	Design and develop a prototype or initial version of the project and showcase progress by highlighting key features and functionalities.
3.	Implement the project based on the developed prototype and conduct rigorous testing to ensure functionality and identify any issues.
4.	Prepare a comprehensive project report following the approved guidelines. Include sections on project objectives, methodology, results, and conclusions. Adhere to proper citation and formatting standards.
5.	Deliver a structured presentation during the Viva-Voce examination.


Total Practical Hours 45

COURSE OUTCOME

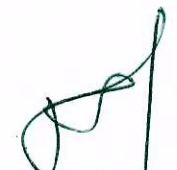
CO1: Demonstrate the application of analytical skills in problem-solving, showcasing their ability to analyze and address complex challenges within the project.
CO2: Proficiency in synthesizing comprehensive project documentation, ensuring clarity, coherence, and alignment with industry standards.
CO3 : Exhibit the successful implementation of innovative and creative solutions, addressing project requirements with forward-thinking approaches.
CO4 : Develop the ability to critically evaluate project success, considering key performance indicators, stakeholder satisfaction, and the overall achievement of project objectives.
CO5 : Demonstrate effective team collaboration, contributing to successful team outcomes through clear communication, shared responsibilities, and mutual support.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Demonstrate the application of analytical skills in problem-solving, showcasing their ability to analyze and address complex challenges within the project.	3	3	3	3	3	1	3	2	2	2	1	1
CO2	Proficiency in synthesizing comprehensive project documentation, ensuring clarity, coherence, and alignment with industry standards.	2	2	1	1	2	1	2	2	2	-	1	-
CO3	Exhibit the successful implementation of innovative and creative solutions, addressing project requirements with forward-thinking approaches.	3	3	3	2	3	1	2	2	2	2	1	-

CO4	Develop the ability to critically evaluate project success, considering key performance indicators, stakeholder satisfaction, and the overall achievement of project objectives.	3	3	3	2	2	1	2	2	2	-	1	1
CO5	Demonstrate effective team collaboration, contributing to successful team outcomes through clear communication, shared responsibilities, and mutual support.	1	1	1	1	1	1	2	2	1	-	3	-
CO PO Mapping Average Value		2.4	2.4	2.2	1.8	2.2	1.0	2.2	2.0	1.8	2.0	1.4	1.0


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PROFESSIONAL ELECTIVE

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 Enable 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 Enable 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
FINANCIAL ACCOUNTING		
I	Financial Accounting – Accounting Concepts and conventions - Double entry principles of book keeping -Journal entry- Ledger-Trial Balance- Final Accounts.	9
FINANCIAL STATEMENT ANALYSIS		
II	Analysis of financial statements -Techniques of financial analysis - Comparative Statement-Common size statement-Trend Analysis-RatioAnalysis.	9
COST AND MANAGEMENT ACCOUNTING		
III	Management Accounting – Funds Flow Analysis - Cash Flow Analysis - Cost Accounting-Functional classification of cost - Preparation of Cost Sheet	9
MARGINAL COSTING AND BUDGETARY CONTROL		
IV	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
FINANCIAL MANAGEMENT		
V	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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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3302	CLOUD COMPUTING AND SECURITY	3	0	0	3

- COURSE OBJECTIVE**
1. Provide an overview of computing paradigms.
 2. Provide an overview of Cloud Computing Architecture and Management.
 3. Explore cloud service models, examining their characteristics, suitability, pros, and cons.
 4. Familiarize with major cloud service providers along with their respective cloud offerings.
 5. Foundational knowledge of cloud information security objectives, confidentiality, integrity, availability, security services, design principles, secure software requirements, and development practices in the cloud.

Pre-requisite – Nil

Unit	Description	Instructional Hours
I	INTRODUCTION: Computing Paradigms High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing. Cloud Computing Fundamentals Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Principles of Cloud computing, Essential Characteristics, Deployment Models	9
II	CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud, Phases of Cloud Migration	9
III	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
IV	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
V	Cloud Computing Software Security fundamentals: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering	9
Total Instructional Hours		45


- COURSE OUTCOME**
- CO1:** Gain a comprehensive understanding of various computing paradigms, setting the foundation for in-depth exploration of cloud computing.
- CO2:** Comprehend the key components of cloud architecture, understand the management aspects, and learn the phases involved in migrating applications to the cloud.
- CO3:** Differentiate between cloud service models, understanding their applications and making informed decisions based on their characteristics.
- CO4:** Gain insights into various cloud service providers, their offerings, and how these providers contribute to the cloud computing landscape.
- CO5:** Analyze the fundamental principles and practices of securing software in cloud computing environments, preparing them for addressing security challenges effectively.

REFERENCE BOOKS:

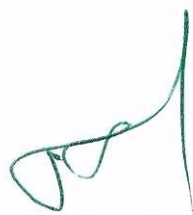
1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, 2011.

4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A Comprehensive Guide to secure Cloud Computing" Wiley.
 5. John W. Rittinghouse James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press.
 6. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Gain a comprehensive understanding of various computing paradigms, setting the foundation for in-depth exploration of cloud computing.	3	3	3	3	2	1	2	2	1	1	1	-
CO2	Comprehend the key components of cloud architecture, understand the management aspects, and learn the phases involved in migrating applications to the cloud.	3	2	3	2	2	1	2	2	1	1	1	-
CO3	Differentiate between cloud service models, understanding their applications and making informed decisions based on their characteristics.	3	3	3	2	2	1	2	2	1	1	1	1
CO4	Gain insights into various cloud service providers, their offerings, and how these providers contribute to the cloud computing landscape.	3	3	3	2	2	1	2	1	1	3	1	-
CO5	Analyze the fundamental principles and practices of securing software in cloud computing environments, preparing them for addressing security challenges effectively.	3	3	3	2	2	1	2	2	1	3	1	-
	CO PO Mapping Average Value	3.0	2.8	3.0	2.2	2.0	1.0	2.0	1.8	1.0	1.8	1.0	1.0


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3303	SOFT COMPUTING TECHNIQUES	3	0	0	3
COURSE OBJECTIVE		1. Gain knowledge on fundamental concepts of fuzzy logic. 2. Overview of neural networks, covering neurons, artificial neurons, activation functions, neural network architecture. 3. Explore back propagation networks, including the architecture of perceptron models, single-layer and multilayer artificial neural networks. 4. Gain knowledge on Competitive neural networks 5. Cover the basic concepts, working principles, procedures, representations, initialization, selection, genetic operators (mutation, crossover), and applications of genetic algorithms.				

Pre-requisite – Nil

Unit	Description	Instructional Hours
	FUZZY COMPUTING	
I	Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Interference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzification and Defuzzification, Fuzzy Controller, Industrial Applications.	9
	FUNDAMENTALS OF NEURAL NETWORKS	
II	Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning techniques, Perception and convergence Rule. Auto-Associative and Hetero-Associative Memory.	9
	BACKPROPAGATION NETWORKS	
III	Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perceptron Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient; Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications	9
	COMPETITIVE NEURAL NETWORKS	
IV	Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure –Applications.	9
	GENETIC ALGORITHM	
V	Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications	9
	Total Instructional Hours	45

COURSE OUTCOME	CO1: Gain a solid understanding of fuzzy logic principles and their practical applications, preparing them for real-world problem-solving using fuzzy computing. CO2: Acquire a foundational understanding of neural networks, enabling them to comprehend their structure, functioning, and learning mechanisms. CO3: Master the principles of back propagation networks, gaining proficiency in designing and implementing neural networks with back propagation learning. CO4: Understand the principles of competitive neural networks and their applications, allowing them to design and apply these networks to solve specific problems. CO5: Equipped with the knowledge to apply genetic algorithms for optimization and problem-solving, fostering a deep understanding of evolutionary computation principles.
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REFERENCES BOOKS:

1. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, 2004.
2. S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications", PHI Learning, 2nd Edition, 2017.
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Third Edition, Wiley, 2018.
4. Simon Haykin, "Neural Networks and Learning Machines", Pearson, 3rd Edition, 2009.
5. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 4th Edition 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3304	DEEP LEARNING	3	0	0	3
COURSE OBJECTIVE	1.	To understand the basic ideas and principles of neural networks.				
	2.	To understand the fundamental concepts of deep learning.				
	3.	Explore CNN architectures, convolution, pooling layers, transfer learning, and applications in image classification.				
	4.	Introduce advanced architectures like LSTM networks, auto encoders, and generative models, along with their applications.				
	5.	Illustrate real-world applications of deep learning, including image segmentation, object detection, natural language processing (NLP), and sentiment analysis.				


Pre-requisite – Nil

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 – Adversarial 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 – Auto encoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Auto encoders – 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: Grasp the foundational principles of neural networks, setting the stage for more advanced topics in deep learning.	
	CO2: Understand the challenges and techniques in training deep models and be equipped to apply them using Tensor Flow and Keras.	
	CO3: Gain expertise in designing and implementing convolutional neural networks, specifically tailored for image-related projects.	
	CO4: Students will be proficient in implementing diverse deep learning architectures and understand their applications in various domains.	
	CO5: Students will be capable of designing and implementing deep learning solutions for a range of applications, demonstrating their critical analysis skills.	

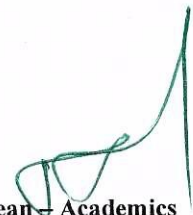
REFERENCE BOOKS:

1. Ian J. Goodfellow, Yoshua Bengio, 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.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Grasp the foundational principles of neural networks, setting the stage for more advanced topics in deep learning.	2	2	1	-	-	2	-	-	2	-	-	-
CO2	Understand the challenges and techniques in training deep models and be equipped to apply them using Tensor Flow and Keras.	2	2	1	-	-	2	-	-	2	-	-	-
CO3	Gain expertise in designing and implementing convolutional neural networks, specifically tailored for image-related projects.	2	2	1	-	-	2	-	-	2	-	-	-
CO4	Students will be proficient in implementing diverse deep learning architectures and understand their applications in various domains	2	2	1	-	-	2	-	-	2	-	-	-
CO5	Students will be capable of designing and implementing deep learning solutions for a range of applications, demonstrating their critical analysis skills	3	2	1	1	-	3	1	-	3	1	-	-
	CO PO Mapping Average Value	2.2	2	1	1	-	2.2	1	-	2.2	1	-	-


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3305	E-COMMERCE	3	0	0	3
COURSE OBJECTIVE	1. Understand the fundamental concepts of Information Technology, its relationship with business, and the impact of E-Commerce on business transformation.					
	2. Explore the essential building blocks of E-Commerce, including Electronic Data Interchange, barcoding, RFID, and Business Process Reengineering.					
	3. Examine legal issues, risks, and technologies associated with cyber security in the context of E-Commerce.					
	4. Explore the legal framework governing E-Commerce, with a focus on the IT Act 2000 and its provisions.					
	5. Analyze real-world case studies to understand the application of E-Commerce principles and strategies.					

Pre-requisite – Nil

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
	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: Gain knowledge about various types of E-Commerce, Internet communication protocols, and key technologies shaping the digital landscape.
	CO2: Explore the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders.
	CO3: Develop an understanding of key cyber security measures such as firewalls, Intrusion Detection Systems, encryption, and secure communication protocols.
	CO4: Gain knowledge about trust in the electronic environment, electronic authentication, and the role of Public Key Infrastructure (PKI) in securing digital transactions.
	CO5: Develop insights into successful E-Commerce implementations through case studies of prominent companies, including their challenges and achievements.

REFERENCE BOOKS:

1. Greenstein, "Electronic Commerce", Tata Mc-Graw Hill Pvt., Ltd., 2000.
2. Kamalesh K. Balaji, Debjani Nag, "E-Commerce", Second Edition, McGraw Hill Education, 2015.
3. Sanjay Mohapatra, "E-Commerce Strategy: Text and Cases", Springer, 2020.
4. C.S.R. Prabhu, E-Governance: Concepts and Case Studies, Springer, 2018.
5. Jeffrey F. Rayport and Bernard J. Jaworski, "Introduction to ECommerce", 2nd Edition, Tata Mc-Graw Hill Pvt., Ltd., 2003.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Gain knowledge about various types of E-Commerce, Internet communication protocols, and key technologies shaping the digital landscape.	3	-	-	1	-	3	1	-	3	1	-	-
CO2	Explore the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders.	-	3	3	2	3	-	2	3	-	2	3	3
CO3	Develop an understanding of key cyber security measures such as firewalls, Intrusion Detection Systems, encryption, and secure communication protocols.	3	-	-	1	-	3	1	-	3	1	-	-
CO4	Gain knowledge about trust in the electronic environment, electronic authentication, and the role of Public Key Infrastructure (PKI) in securing digital transactions.	3	-	-	1	-	3	1	-	3	1	-	-
CO5	Develop insights into successful E-Commerce implementations through case studies of prominent companies, including their challenges and achievements.	3	-	-	1	-	3	1	-	3	1	-	-
	CO PO Mapping Average Value	2.4	0.6	0.6	1.2	0.6	2.4	1.2	0.6	2.4	1.2	0.6	0.6


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3306	MIXED REALITY	3	0	0	3

- COURSE OBJECTIVE**
1. Gain an understanding of Virtual Reality (VR) and Augmented Reality (AR), including their definitions, key components, and benefits.
 2. Explore the computing architectures of VR and AR.
 3. Learn the principles of modeling in Mixed Reality (MR), covering geometric modeling, kinematics modeling, physical modeling, and behavior modeling.
 4. Develop proficiency in programming for VR and MR, exploring toolkits, scene graphs, and human factors in VR.
 5. Explore various applications of MR in different fields.

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 & VR COMPUTING ARCHITECTURE 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– Object Hierarchies–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 World Tool kit and Java3D – 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 MR 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: Understand the fundamentals of AR and VR systems
 - CO2: Knowledge of different computing architectures used in VR and AR,
 - CO3: Acquire skills in creating virtual object shapes, understanding object hierarchies, and applying modeling techniques for realistic interactions in MR environments.
 - CO4: Able to use VR programming toolkits, design interfaces for VR applications, and address health and safety issues related to VR.
 - CO5: Gain insights into real-world applications of MR and understand its impact on diverse fields, paving the way for creative and practical use in their future endeavors.

REFERENCE BOOKS:

R1. Grigore C. Burdea, Philip Coiffet, “Virtual Reality Technology”, Second Edition, Wiley India, 2017.
R2. Benford, S., GiannachiG., “Performing Mixed Reality”, MIT Press, 2011.
R3. Charles Palmer,John Williamson, “Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile”, Packt Publisher, 2018.
R4. Jason Jerald, “The VR Book: Human-Centered Design for Virtual Reality” Association for Computing Machinery and Morgan, Claypool Publishers, 2015

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

R6. .Kelly S.Hale, Kay M.Stanney Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition, CRC press, 2014

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand the fundamentals of AR and VR systems	2	-	-	-	-	2	-	-	2	-	-	-
CO2	Knowledge of different computing architectures used in VR and AR,	2	-	-	-	-	2	-	-	2	-	-	-
CO3	Acquire skills in creating virtual object shapes, understanding object hierarchies, and applying modeling techniques for realistic interactions in MR environments.	2	1	1	2	1	2	2	1	2	2	1	1
CO4	Able to use VR programming toolkits, design interfaces for VR applications, and address health and safety issues related to VR.	2	-	-	-	-	2	-	-	2	-	-	-
CO5	Gain insights into real-world applications of MR and understand its impact on diverse fields, paving the way for creative and practical use in their future endeavors.	2	1	1	2	-	2	2	-	2	2	-	-
	CO PO Mapping Average Value	2	0.7	0.7	0.8	0.3	2.0	0.8	0.3	2.0	0.8	0.3	0.3


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3307	ORGANIZATIONAL BEHAVIOR	3	0	0	3
COURSE OBJECTIVE	1. Gain Foundational understanding of organizational behavior models and key elements of organizational 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.					


Pre-requisite – Nil

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 behavior models. Organization structure: key elements – common organizational designs - determinants.	9
II	INDIVIDUAL BEHAVIOR 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 BEHAVIOR 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: Able to describe the functions and roles of managers, identify key elements of organizational behavior models, and analyze organizational structures. CO2: Understand aspects like personality, learning, emotions, attitudes, perceptions, motivation etc which affects individual's behaviour in an organization. CO3: Able to analyze group dynamics, identify factors influencing perception and communication, and understand the role of groups and teams in organizations. CO4: Develop insights into leadership styles, understand power dynamics, and analyze the influence of politics in organizational settings. CO5: Able to analyze organizational culture, understand the dynamics of change, and propose strategies for managing stress in organizational contexts	

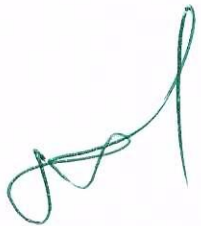
REFERENCE BOOKS:

- 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.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Able to describe the functions and roles of managers, identify key elements of organizational behavior models, and analyze organizational structures.	2	-	-	-	-	2	-	-	2	-	-	-
CO2	Understand aspects like personality, learning, emotions, attitudes, perceptions, motivation etc which affects individual's behaviour in an organization.	2	1	1	2	1	2	2	1	2	2	1	1
CO3	Able to analyze group dynamics, identify factors influencing perception and communication, and understand the role of groups and teams in organizations.	2	1	1	2	1	2	2	1	2	2	1	1
CO4	Develop insights into leadership styles, understand power dynamics, and analyze the influence of politics in organizational settings.	2	1	1	2	1	2	2	1	2	2	1	1
CO5	Able to analyze organizational culture, understand the dynamics of change, and propose strategies for managing stress in organizational contexts	2	FALSE	FALSE	-	-	2	-	-	2	-	-	-
CO PO Mapping Average Value		2	0.75	0.75	1.2	0.6	2	1.2	0.6	2	1.2	0.6	0.6


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3308	RESEARCH METHODOLOGY	3	0	0	3
COURSE OBJECTIVE	1. To identify the methods of formulating appropriate research problem. 2. Master effective literature review approaches, including analysis, avoiding plagiarism, and adhering to research ethics. 3. Enhance skills in technical writing, including report and paper writing. 4. Understand the nature of intellectual property, including patents, designs, trade, and copyright.. 5. Examine patent rights, licensing, transfer of technology, patent information, databases, geographical indications, and new developments in intellectual property rights.					

Pre-requisite – Nil

Unit	Description	Instructional Hours
	RESEARCH PROBLEM FORMULATION	
I	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
	LITERATURE REVIEW	
II	Effective literature studies approaches, analysis, plagiarism, and research ethics.	9
	TECHNICAL WRITING /PRESENTATION	
III	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
	INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)	
IV	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
	INTELLECTUAL PROPERTY RIGHTS (IPR)	
V	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	DESCRIPTION
	CO1. Able to formulate research problems, assess their characteristics, and design appropriate methodologies for investigation.
	CO2. Demonstrate proficiency in conducting literature reviews, critically analyzing existing studies, and ensuring ethical practices.
	CO3. Able to produce high-quality technical documents, research proposals, and deliver compelling presentations.
	CO4. Gain insights into the basics of intellectual property, patenting procedures, and international aspects of intellectual property rights.
	CO5. Develop an understanding of the scope of patent rights, licensing processes, and the broader landscape of intellectual property rights, including recent developments.


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. 37th ed. (Rev)Sultan Chand and Sons. New Delhi. 1470 p.
- R5. Leon & Leon (2002). 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

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Able to formulate research problems, assess their characteristics, and design appropriate methodologies for investigation.	3	-	-	1	-	3	1	-	3	1	-	-
CO2	Demonstrate proficiency in conducting literature reviews, critically analyzing existing studies, and ensuring ethical practices.	2	-	-	-	-	2	-	-	2	-	-	-
CO3	Able to produce high-quality technical documents, research proposals, and deliver compelling presentations.	1	2	2	3	2	1	3	2	1	3	2	2
CO4	Gain insights into the basics of intellectual property, patenting procedures, and international aspects of intellectual property rights.	2	-	-	-	-	2	-	-	2	-	-	-
CO5	Develop an understanding of the scope of patent rights, licensing processes, and the broader landscape of intellectual property rights, including recent developments.	2	1	1	2	-	2	2	-	2	2	-	-
	CO PO Mapping Average Value	2.0	1.0	1.0	1.2	0.7	2.0	1.2	0.7	2.0	1.2	0.7	0.7


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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. Gain proficiency in languages essential for the semantic web.					
	3. Understand the processes and methods involved in ontology learning for the semantic web.					
	4. Comprehend the need for ontology management, the development process, ontology mapping, and the evolution of ontologies.					
	5. Explore various applications of semantic web technologies, including web services, semantic web services, security issues, and applications in specific domains.					

Pre-requisite - Nil

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
	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: Equipped with a solid understanding of semantic web technologies, ontological commitments, and different types of ontologies.
	CO2: Develop skills in working with semantic web languages and ontologies, facilitating effective knowledge representation.
	CO3: Capable of employing ontology learning algorithms, importing and processing ontologies, and evaluating the quality of ontologies.
	CO4: Proficient in managing ontologies, dealing with issues in development, and utilizing ontology management tools effectively.
	CO5: Gain insights into practical applications of semantic web technologies across different domains, including web services, life sciences, and data formats.

REFERENCES BOOKS:

1. Pascal Hitzler, Markus Krotzsch, 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.

	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Equipped with a solid understanding of semantic web technologies, ontological commitments, and different types of ontologies.	3	-	-	1	-	3	1	-	3	1	-	-
CO2	Develop skills in working with semantic web languages and ontologies, facilitating effective knowledge representation.	2	-	-	-	-	2	-	-	2	-	-	-
CO3	Capable of employing ontology learning algorithms, importing and processing ontologies, and evaluating the quality of ontologies.	1	2	2	3	2	1	3	2	1	3	2	2
CO4	Proficient in managing ontologies, dealing with issues in development, and utilizing ontology management tools effectively.	2	-	-	-	-	2	-	-	2	-	-	-
CO5	: Gain insights into practical applications of semantic web technologies across different domains, including web services, life sciences, and data formats.	2	1	1	2	-	2	2	-	2	2	-	-
	CO PO Mapping Average Value	2.0	1.0	1.0	1.2	0.7	2.0	1.2	0.7	2.0	1.2	0.7	0.7


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