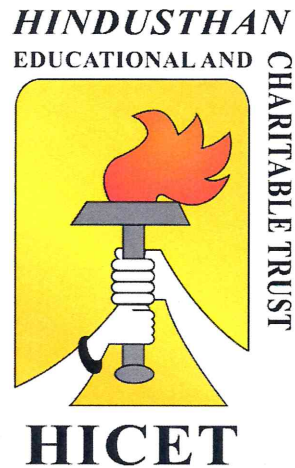


***HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY***  
**(An Autonomous Institution Affiliated to Anna University, Chennai)**  
**(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)**  
**COIMBATORE 641 032**

**M.C.A. (COMPUTER APPLICATIONS)**



**(CHOICE BASED CREDIT SYSTEM)**

**Curriculum & Syllabus**

**2021-2022**

## VISION AND MISSION OF THE INSTITUTION

### VISION

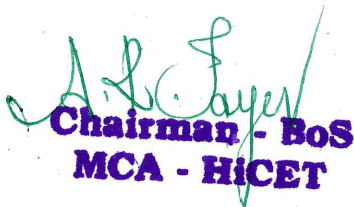
To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

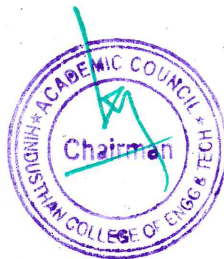
### MISSION

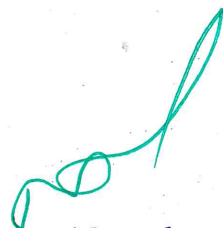
IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

  
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**HICET**

## VISION AND MISSION OF THE DEPARTMENT

### VISION

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

### MISSION

To achieve the vision of the department with sustained efforts to,


DM1: develop curriculum and delivery approaches that will give exposure to the learners both horizontally and vertically.

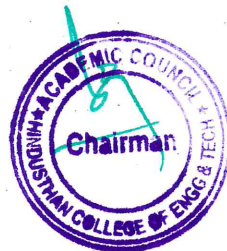
DM2: provide opportunity to faculty to upgrade their knowledge and skills related to computer applications for supporting the programs offered through their domain expertise.

DM3: To create connections with local, national and international opportunities to share, utilize and exchange computer application expertise.

DM4: Conduct outreach activities for the society that involves use of computer applications expertise to deal with societal issues.

DM5: Create and upgrade contemporary facilities for offering education related to computer applications.

  
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## PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- PO 1. **Computational knowledge:** An ability to apply appropriate knowledge of computing fundamentals, mathematics and knowledge of specific domain to model application software.
- PO 2. **Problem analysis:** An ability to provide solutions to complex computing problems by analyzing, formulating the problem.
- PO 3. **Design/development of solutions:** An ability to design, implement and evaluate sustainable computation solutions in the form of processes and components as per specifications.
- PO 4. **Conduct investigations of complex problems:** An ability to provide valid conclusions using research based methods and to perform computing practices using state of art technologies. tools and techniques.
- PO 5. **Modern tool usage:** An ability to use modern software tools and technologies to develop applications for practical problems.
- PO 6. **Professional Ethics:** An ability to apply principles of management to manage projects and to develop soft skills and to practice professional ethics in multiple disciplines.
- PO 7. **Life Long Learning :** An ability to involve in continual development as computing professional through self-learning.
- PO 8. **Project Management and Finance:** An ability to demonstrate knowledge of computation in management principles and to manage projects in multidisciplinary environments.

  
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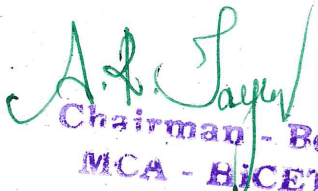
- PO 9. **Communication Efficiency:** An ability to interchange information effectively through verbal and written form
- PO10. **Societal and Environmental Concern:** An ability to assess the impact of computing on health, safety and culture
- PO11. **Individual and Team Work :** Function effectively as an individual and as a member in team
- PO12. **Innovation and Entrepreneurship:** An ability to adapt software engineering practices and to succeed as an employee or an entrepreneur.

### PROGRAM SPECIFIC OUTCOMES (PSOs)

- PSO 1. Design application software projects to meet the demands of industry requirements using modern tools and technologies.
- PSO 2. Analyze societal needs to provide solutions through technology based research.

### 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.

  
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# **CURRICULUM**

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS  
CBCS PATTERN  
POST GRADUATE PROGRAMMES  
M.C.A MASTER OF COMPUTER APPLICATIONS  
REGULATION-2020**

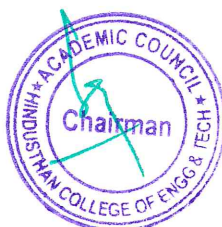
For the students admitted during the academic year 2021-2022 and onwards

**SEMESTER I - BRIDGE COURSE**

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

**SEMESTER I – REGULAR COURSE**

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1.	21MA1101	Probability And Statistics, Operations Research	FC	3	1	0	4	40	60	100
2.	21CA1201	UI Design & Development	PC	3	1	0	4	40	60	100
3.	21CA1202	Computer Networks	PC	3	0	0	3	40	60	100
4.	21CA1203	Java Programming	IC	3	1	0	4	40	60	100
5.	21CA1204	Database Management Systems	IC	3	0	0	3	40	60	100
<b>PRACTICAL</b>										
6.	21CA1001	Java Programming Lab	EEC	0	0	3	1.5	50	50	100
7.	21CA1002	DBMS Lab	EEC	0	0	3	1.5	50	50	100
8.	21CA1171	Communicative Skill for Business English	EEC	0	0	4	2	100	0	100
<b>Total</b>				<b>15</b>	<b>3</b>	<b>10</b>	<b>23</b>	<b>400</b>	<b>400</b>	<b>800</b>



**SEMESTER II – BRIDGE COURSE**

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

**SEMESTER II – REGULAR COURSE**

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
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	0	100
<b>PRACTICAL</b>										
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	0	100
<b>Total</b>				<b>17</b>	<b>3</b>	<b>6</b>	<b>25</b>	<b>500</b>	<b>400</b>	<b>900</b>

**LIST OF PROFESSIONAL ELECTIVES**

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
<b>PROFESSIONAL ELECTIVE I</b>										
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	PE	3	0	0	3	40	60	100





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

**SEMESTER III**

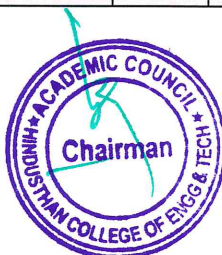
S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1.	20CA3201	Big Data Analytics	PC	3	1	0	4	40	60	100
2.	20CA3202	Operating Systems	PC	3	1	0	4	40	60	100
3.	20CA3203	Web Development	PC	3	1	0	4	40	60	100
4.	20CA3204	Artificial Intelligence	IC	3	0	0	3	40	60	100
5.	20CA33XX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

**SEMESTER IV**

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

**LIST OF PROFESSIONAL ELECTIVES**

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



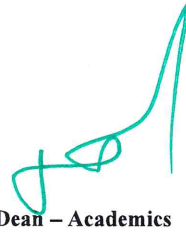
**CREDIT DISTRIBUTION**

**R2020**

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

  
Chairman, Board of Studies

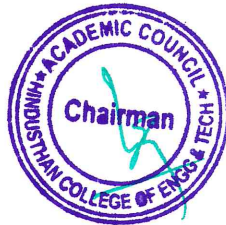
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HiCET**

Principal

**PRINCIPAL**  
Hindusthan College Of Engineering & Technology  
COIMBATORE - 641 052.



# **SYLLABUS**

**SEMESTER I- BRIDGE COURSE**


**ODD SEM**

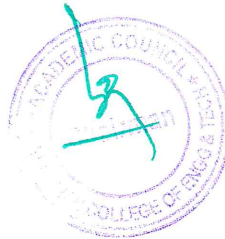
<b>Programme</b>	<b>Course Code</b>	<b>Name of the Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
MCA	21CA1291	PoP& OOPS	3	0	0	0

<b>Unit</b>	<b>Description</b>	<b>Instructional hours</b>
I	Introduction in C- Process of programming – Variables- Operators – Loops- Break statement – Continue Statement- Data Types in C – ASCII Code - Operators Expressions Associatively - Precedence of operators - Expression evaluation – Functions	9
II	Arrays 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 Evolution of OOP Languages – Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings- Function Overloading - Operator Overloading - Dynamic Memory Management	9
III	Classes and Objects -Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator- Constants - Static Members - friend Function and friend Class	9
IV	Overloading Operator for User Defined Types-Namespace -Inheritance -Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions –Template -Closing Comments	9
V		
<b>Total Instructional hours</b>		<b>45</b>

**REFERENCES:**

R1. [https://onlinecourses.nptel.ac.in/noc19\\_cs42/preview](https://onlinecourses.nptel.ac.in/noc19_cs42/preview)

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

Unit	Description	Instructional hours
	<b>INTRODUCTION TO WWW</b>	
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
	<b>UI DESIGN</b>	
II	Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts - Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists	9
	<b>CASCADING STYLE SHEET (CSS)</b>	
III	The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets	9
	<b>CASCADING STYLE SHEET (CSS)</b>	
IV	Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.	9
	<b>SCRIPTING LANGUAGES</b>	
V	HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**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.

*A. B. Jayar*  
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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1091	PoP& OOPS LAB	0	0	3	0

S.no	Description of the experiments	practical 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
	Write a C++ program to perform String Concatenation	
7.	<ul style="list-style-type: none"> <li>• using Arrays</li> <li>• Using Functions</li> <li>• Using Arrays &amp; functions</li> <li>• Using Pointers &amp; Functions</li> </ul>	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
<b>Total Instructional hours</b>		<b>45</b>

  
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## **SEMESTER I – REGULAR COURSES**



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

- COURSE OBJECTIVE
1. Construct a well-defined knowledge of probability and random variables.
  2. Apply testing of hypothesis to infer outcome of experiments.
  3. Understand the concept of basic concepts in Operations Research Techniques for Analysis and Modeling in Computer Applications.
  4. Know the concept of mathematical model in Transportation and Assignment problems.
  5. Understand the concept of network modeling for planning and scheduling the project

Unit	Description	Instructional Hours
	<b>PROBABILITY AND RANDOM VARIABLE</b>	
I	Definition – Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem (without proof) -Random variable –Discrete and continuous random variables – Moment generating functions.	12
	<b>TESTING OF HYPOTHESES</b>	
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
	<b>LINEAR PROGRAMMING MODELS</b>	
III	Mathematical Formulation of LPP- Graphical method– Simplex method – Artificial variable Techniques- Sensitivity analysis.	12
	<b>TRANSPORTATION AND ASSIGNMENT MODELS</b>	
IV	Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.	12
	<b>SCHEDULING BY PERT AND CPM</b>	
V	Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.	12
<b>Total Instructional Hours</b>		<b>60</b>

- COURSE OUTCOME
- CO1: Understand the concepts of probability and random variables.  
CO2: Acquire the basic concepts of Probability and Statistical techniques for solving mathematical problem.  
CO3: Describe various linear, integer programming to solve operational problem with constraints.  
CO4: Understand and to find optimal solution in warehousing and Travelling by apply transportation and assignment models.  
CO5: Obtain a fundamental knowledge of project scheduling using PERT and CPM.

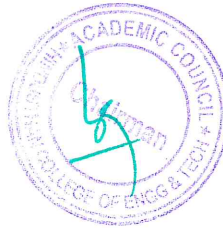
**TEXT BOOKS:**

1. Veerarajan, T., Probability, Statistics and Random Processes, Tata McGraw-Hill, 2<sup>nd</sup> 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.

  
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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1201	UI DESIGN & DEVELOPMENT	3	1	0	4

- COURSE OBJECTIVE
1. To Understand the basics of world wide web
  2. To create a basic website using HTML and Cascading Style Sheets.
  3. To Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
  4. To Design rich client presentation using AJAX.
  5. To Design and implement simple web page in PHP.

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

Course Outcome CO1: Able to Understand the basics of world wide web  
CO2: Able to Create website using HTML and Cascading Style Sheets.  
CO3: Able to design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.  
CO4: Able to design rich client presentation using AJAX.  
CO5: Able to Design and implement simple web page in PHP.

**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" AddisonWesley, Pearson 2009
- R4. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010
- R5. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
- R6. Thomas A Powell, "Ajax: The Complete Reference", McGraw Hill, 2008

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

**COURSE OBJECTIVE**

- 1.To understand networking concepts and basic communication model
- 2.To analyze the function and design strategy of physical, data link, network layer and transport layer
- 3.To acquire basic knowledge of various application protocol for internet security issues and services applied in presentation Layer.
4. To learn the Transport layer protocols TCP & UDP and Congestion principles.
5. To understand the Network Security concepts applied in Presentation layer

Unit	Description	Instructional Hours
	<b>NETWORK FUNDAMENTALS</b>	
I	Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocols – OSI– LAN Topology - Transmission media.	9
	<b>DATA LINK LAYER</b>	
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
	<b>NETWORK LAYER</b>	
III	Switching concepts – Circuit switching – Packet switching –IPV4, IPV6 –IP address Hierarchy – ICMP – Routing Protocols – Distance Vector – Link State.	9
	<b>TRANSPORT LAYER</b>	
IV	Functions of Transport Layer -, Connection Establishment, Connection Release, Flow Control – Sliding Window protocol, UDP, TCP, Congestion control and Avoidance.	9
	<b>REAL TIME APPLICATIONS&amp; NETWORK SECURITY</b>	
V	DHCP – LDAP – HTTP – HTTPS – Packet Tracer – Cryptography – Ciphers – RSA algorithm – Web Security & Threats.	9
<b>Total Instructional Hours</b>		<b>45</b>

**COURSE OUTCOME**

CO1: Able to Understand the terminologies of Networks and Layers in a Network.  
CO2: Able to understand the working principles of Data Link Layer, its functions and Network technology applied in LAN.  
CO3: Able to understand the functionalities of Network Layer, IP addressing Mechanism and Routing Protocols.  
CO4: Able to learn the Transport layer protocols TCP & UDP and Congestion principles.  
CO5: Able to understand the Network Security concepts applied in Presentation layer.

**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

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

- COURSE OBJECTIVE
1. To impart the fundamental concepts of core JAVA.
  2. To explain the concepts of Multithreading
  3. To explore the skills in program development using Exception handling and I/O programming
  4. To gain the built-in knowledge of standalone and web applications.
  5. To understand the concepts needed for database connectivity.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Java Features – The Byte Code – Operators- Control Structures - Class Fundamentals – Objects – Overloading Methods – Passing and returning objects – Recursion – Controlling access to members – this keyword - static and final keyword.	12
	<b>OOPS</b>	
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 - Packages – Access modifiers – Importing packages – Interfaces – Applying Interfaces-Abstraction-Package	12
	<b>EXCEPTION HANDLING &amp; THREADS</b>	
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.	12
	<b>FRAMES &amp; APPLETS</b>	
IV	Java Frame – basic GUI components – Delegation event model - Event Classes– Source of events – Event Listener Interface – Applet Programming.	12
	<b>FILES &amp; DATABASES</b>	
V	I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Java Collections	12
<b>Total Instructional Hours</b>		<b>60</b>

- COURSE OUTCOME
- CO1: Apprehend the syntax, semantics of Java programming language and create applications using classes and objects  
CO2: Design and create new applications by applying reusability and Packages concept  
CO3: Apply Multithreading concepts to execute parallelism and explore the concept of Exception handling.  
CO4: Implement programs using Frames, Event handlers and Applets  
CO5: Synthesize rich applications using I/O, Files, JDBC and System/Utility classes

**REFERENCE BOOKS:**

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

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

COURSE OBJECTIVE	
	1. To remember the fundamentals of Database Management Systems and Relational Model.
	2. To understand the concepts of Relational Algebra and SQL queries.
	3. To make the students to understand the Schemas and Normalization.
	4. To understand Transaction Management and Concurrency Control.
	5. To understand ODBMS, ORDBMS and No SQL databases.

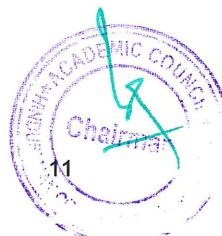
Unit	Description	Instructional hours
	<b>INTRODUCTION, DATABASE DESIGN AND RELATIONAL MODEL</b>	
I	Introduction-Database System Applications, Purpose of Database Systems, View of Data – Database Languages, Database and Application Architecture, Database Users and Administrators – Database Schema – Keys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

COURSE OUTCOME	
	CO1: To remember the database fundamentals, database design and relational model.
	CO2: To identify various methods in Relational Algebra and to write various SQL statements.
	CO3: To understand Advanced SQL concepts, Functional Dependencies and various normal forms to be used in the database tables.
	CO4: To manage transactions in the tables and to control the concurrency of data in the databases.
	CO5: To be familiar with Specialty and NoSql Database.

#### 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).

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

COURSE OBJECTIVE	Description
	1. To apply the object concepts, command line arguments, methods, date and array of objects in Java programs.
	2. To build programs to learn inheritances, interface, packages, applets and graphics
	3. To construct programs to use exceptions and handle various events with swing.
	4. To develop programs to apply i/o concepts, multithreading and access database from GUI.
	5. To implement RMI and Servlets in real world applications.

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



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

	CO1: Able to create object for the class and to input the values during run time.
COURSE	CO2: Able to write programs in inheritance and achieve reusability. Moreover, to implement interface, package, applet and graphics
OUTCOME	CO3: Able to develop programs to understand built in exception and custom exception.
	CO4: Able to build programs in I/O Stream classes and threads, as well to connect databases.
	CO5: Able to connect client with server programs using RMI and to use web apps in servlets.

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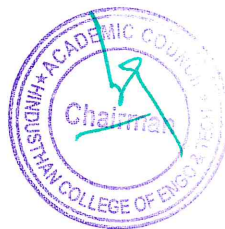
Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1002	DBMS LAB	0	0	3	1.5

COURSE OBJECTIVE	
	1. To give a better insight about ER and DFD.
	2. To develop conceptual understanding of database management system
	3. To understand how a real-world problem can be mapped to schemas
	4. To develop understanding of different applications and constructs of SQL, PL/SQL.
	5. To introduce the concepts of transactions and transaction processing

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
<b>Total Instructional hours</b>		<b>45</b>

COURSE OUTCOME	
	CO1: Able to Construct ER and DFD Diagram
	CO2: Ability to formulate SQL queries and PL/SQL based on the problems given
	CO3: Ability to Implements Joins and Subqueries
	CO4: Ability to Normalize the database.
	CO5: Ability to Practice Block chain Ethereum.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1171	COMMUNICATION SKILL FOR BUSINESS ENGLISH	0	0	4	2

- COURSE OBJECTIVE
1. To understand the fundamentals of Business Communication and its application in real life
  2. Able to know what are the combination of speaking skills to use while conveying the message to the receiver
  3. Able to think, learn, understand, decide on a problem and communicate clearly to get it solved in real life.
  4. To understand and also able to write for different messages using various techniques (ex: email, notice, pamphlets etc)
  5. Able to know about the Nonverbal Communication methods and para verbal methods to convey the information/message

Unit	Description	Instructional Hours
	<b>DESCRIBE BASIC COMMUNICATION PRINCIPLES &amp; PLAN FOR EFFECTIVE COMMUNICATION</b>	
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
	<b>PLAN FOR EFFECTIVE COMMUNICATION &amp; APPLY BEST PRACTICES FOR CREATING BUSINESS DELIVERABLES</b>	
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
	<b>DELIVER YOUR MESSAGE</b>	
III	Describe the variables involved in delivering an effective message - Identify methods of adapting a message based on audience feedback	9
	<b>RECEIVE COMMUNICATIONS</b>	
IV	Given a business communication, restate the key points of the –message - Given a message, identify appropriate responses or clarifying-questions	9
	<b>ANALYZE COMMUNICATION SCENARIOS</b>	
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
<b>Total Instructional Hours</b>		<b>45</b>

- 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

  
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**SEMESTER II - BRIDGE COURSE**  
**EVEN SEM**

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

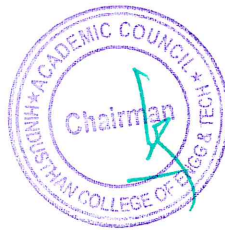
Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Agile model - Prototype Model – Fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification.	9
	<b>SOFTWARE DESIGN</b>	
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
	<b>SOFTWARE TESTING</b>	
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
	<b>MAINTENANCE</b>	
IV	Software Maintenance Organization – Maintenance Report – Types of Maintenance- Software maintenance activities-Software reverse engineering	9
	<b>SOFTWARE METRICS</b>	
V	Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards	9
<b>Total Instructional hours</b>		<b>45</b>

COURSE OUTCOME	
	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, McGrawHill, 2010.
- R2. Richard Fairley, " Software Engineering Concepts", Tata McGraw Hill Edition, 2008
- R3. Ali Behforroz, Frederick J.Hudson, "Software Engineering Fundamentals", Oxford Indian Reprint, 2012
- R4. Sommerville, "Software Engineering", Sixth Edition, AddisonWesley-Longman, 2004.
- R5. Kassem A. Saleh, "Software Engineering", First Edition, J.Ross Publishing, 2009.
- R6. Pankaj Jalote, "An Integrated approach to Software Engineering", Third Edition, Springer Verlag, 2005.

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

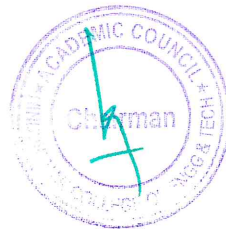
Unit	Description	Instructional hours
	<b>OS INTRODUCTION AND PROCESS MANAGEMENT AND SCHEDULING ALGORITHMS</b>	
	<b>Introduction:</b> Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, System Calls, Operating System Structure	
I	<b>Processes:</b> Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. <b>Process Scheduling:</b> Basic concepts of scheduling, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. <b>Scheduling algorithms:</b> Pre-emptive and non-pre-emptive, FCFS, SJF, RR; <b>PROCESS SYNCHRONIZATION,</b>	9
II	<b>Inter-process Communication:</b> 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 <b>Concurrent Programming:</b> Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery. .	9
III	<b>THREADS AND DEADLOCKS</b> <b>Thread:</b> Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. <b>Deadlocks:</b> Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery	9
IV	<b>MEMORY MANAGEMENT</b> <b>Memory Management:</b> Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. <b>Virtual Memory:</b> 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
V	<b>FILE SYSTEMS MANAGEMENT, I/O AND DISK MANAGEMENT</b> <b>File Management:</b> 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), <b>I/O Hardware:</b> I/O devices, Device controllers, Direct Memory Access, Principles of I/O. <b>Disk Management:</b> Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	9
<b>Total Instructional hours</b>		<b>45</b>

COURSE OUTCOME	<p>CO1: Describe the various OS functionalities, structures Process Management and Scheduling Algorithms</p> <p>CO2: Apply and explore the communication between inter process and synchronization techniques.</p> <p>CO3: Understand Threads and Deadlock.</p> <p>CO4: Implement memory placement strategies, replacement algorithms related to main and virtual memory techniques</p> <p>CO5: Differentiate the file systems for applying various file allocation and access techniques, I/O and Disk Scheduling Strategies</p>
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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	0

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

**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   |    |

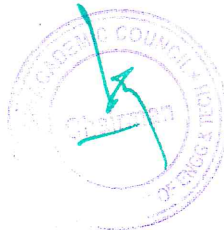
For the Following Scenario

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

**Total Instructional hours 45**

- Course Outcome
- 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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**HICET**

## **SEMESTER II – REGULAR COURSES**

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

**COURSE OBJECTIVE**

1. To understand the core topics of data structures and to unleash the concepts of linear data structures.
2. Be exposed to sorting, searching and hashing algorithms
3. To introduce Non-linear data structures trees and Graphs.
4. To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
5. To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements.

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

**COURSE OUTCOME**

CO1: Able to understand the fundamental topics of linear data structures Arrays, Pointers, Structures, Linked Lists, Stack and queues.

CO2: Able to understand different implementation and algorithms related to searching, sorting and Hashing methods.

CO3: Able to understand the concept of important data structure like Trees and Graphs.

CO4: Able to understand various algorithmic strategies.

CO5: Able to build a complete algorithmic solution to a given problem.

**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- 20<sup>th</sup> 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

*A. S. Jayar*  
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**HICET**

Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2202	ARTIFICIAL INTELLIGENCE	3	1	0	4

- COURSE OBJECTIVE
1. Gain a historical perspective of AI and its foundations.
  2. To provide a strong foundation and a basic exposition of fundamental concepts, its goals and methods of Artificial Intelligence.
  3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
  4. To enable the student to understand the application of Artificial Intelligence techniques which involve perception, reasoning and learning.
  5. Explore the current scope, potential, limitations, and implications of intelligent systems.

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

COURSE OUTCOME	<p>CO1: Remember fundamental understanding of the history of artificial intelligence (AI) and its foundations.</p> <p>CO2: Understand and Remember the fundamental concepts and methods of Artificial Intelligence.</p> <p>CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.</p> <p>CO4: Understand the basic principles of AI in solutions that require problem solving, perception, knowledge representation, and learning.</p> <p>CO5: Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.</p>
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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	21CA2203	PYTHON PROGRAMMING	3	1	0	4

- COURSE OBJECTIVE**
1. Develop an understanding on the basic concepts of Python Fundamentals
  2. To understand Functions, Classes and Objects, regular Expressions, and packages.
  3. To understand Web Development Concepts with database Connectivity.
  4. To Perform Data Visualization using various Plotting Tools
  5. To develop Exploratory Data Analysis, Data Preparation and Preprocessing on a data set and Perform Training and Testing & Implementation of Model

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

- COURSE OUTCOME**
- CO1: Understand the basic concepts of Python Fundamentals.  
CO2: Design applications using basic data structures of Python and Regular Expressions.  
CO3: To understand the concepts of Exception Handling, OOPs concepts and development of web application with database connectivity  
CO4: Implement Data Visualization using various Plotting Tools.  
CO4: To Implement Exploratory Data Analysis , Data Preparation and Preprocessing Testing and Training Data set and Model Implementation.

**REFERENCE BOOKS:**

- R1- Ryan Marvin, Mark Nganga, Amos Omondi, “Python Fundamentals”, Packt Publishing 2018  
R2- Dave Kuhlman, A Python Book: Beginning Python, AdvancedPython, and Python Exercises, Open-Source MIT License, 2013.  
R3 - Samir Madhavan, Mastering Python for Data Science, PacktPublishing, 2015  
R4 - Jake VanderPlas, Python Data Science Handbook, Essential Tools for Working with Data, O’Reilly Media, Inc., 2017  
R5 – ArunRavindran, SamuelDauzon AidasBendoraitis, Django: Web Development with Python, Pack Publishing, 2017  
R6 - Miguel Grinberg, Flask Web Development, 2nd Edition, O'Reilly Media, Inc., 2018

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

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

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

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

**TEXT BOOKS:**

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

**REFERENCES:**

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

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

**COURSE OBJECTIVE**

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

S.no	Description of the experiments	practical hours								
1	<p><b>Develop programs to understand the control structures of python</b> FoodCorner home delivers vegetarian and non-vegetarian combos to its customer based on order.</p> <p>A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo.</p> <p>Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Distance in kms</th> <th>Delivery charge in Rs per km</th> </tr> </thead> <tbody> <tr> <td>For first 3kms</td> <td>0</td> </tr> <tr> <td>For next 3kms</td> <td>3</td> </tr> <tr> <td>For the remaining</td> <td>6</td> </tr> </tbody> </table> <p>Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer.</p> <p>The below information must be used to check the validity of the data provided by the customer:</p> <ul style="list-style-type: none"> <li>• Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.</li> <li>• Distance in kms must be greater than 0.</li> <li>• Quantity ordered should be minimum 1.</li> </ul> <p>If any of the input is invalid, the bill amount should be considered as -1.</p>	Distance in kms	Delivery charge in Rs per km	For first 3kms	0	For next 3kms	3	For the remaining	6	3
Distance in kms	Delivery charge in Rs per km									
For first 3kms	0									
For next 3kms	3									
For the remaining	6									
2	<p><b>Develop programs to learn different types of structures (list, dictionary, tuples) in python</b> Mohan has got lot of friends all around the world. All of them have the interesting habit of sending letters to each other to express their feelings. Mohan has the practice of keeping all the stamps pasted on the letters safely. On every New Year day, he arranges all the stamps of preceding year according to the month of arrival, puts it on a small cover (stamps of four months are put in same cover) and indexes it with numbers. For example, 1 to represent January to April, 2 to represent May to august etc.. Along with the index, the number of stamps for those months is also stored. He then puts everything in a big cover and labels it with year number. At the age of 35, he has got around 3 such covers labeled with years of arrival. Mohan's cute son wants to see</p>	6								



	how many stamps he has collected in August '2007. Help him to find out by writing a python code. (Assume that the covers are not in sequence).	
3	<p><b>Strings &amp; Functions</b></p> <p>The details of all employees (ID no, name, mobile number) of a company XYZ is stored and maintained by the company's IT department. On his birthday, the GM of the company wants to surprise a few of his employees with experience more than five years and whose ID number is divisible by 5 by giving Rs.5000. He instructs the IT department to display the mobile number along with the name of all employees who are eligible for gift. Write a program to automate the selection and intimation. Name of a person is in the form initial (One letter), dot and any number of alphabets, spaces. Check the validity of the name entered and validity of the mobile number. A valid mobile number must consist of 10 digits and the first digit must not be zero. Print 'Invalid input' when conditions are not satisfied and break the process of getting input. Use functions.</p>	6
4	<p><b>Regular Expressions &amp; Packages</b></p> <p>Automatic toll collection centers scan the vehicle's number plate and check whether the vehicle belongs to Tamilnadu (TN) or Kerala (KL). The structure of a vehicle number is as follows: Two alphabets indicating the state, followed by two numbers representing the code of registration centre. This is followed by two alphabets and two numbers representing the sequence of registrations. Example: TN12 AL1143 is a valid no whereas TN12 A123 is not valid. Write a Python program to check whether the vehicle number scanned is valid and hence check whether the vehicle belongs to TN or KL.</p>	6
5	<p><b>Exception Handling</b></p> <p>Online shopping website 'X' sells many interesting items by showing the catalogs. The users can give the item code (a six character string with three alphabets followed by three digits), quantity required (number) and the color (string) required. Write a program using Python that prompts the user all these details and displays the total amount to be paid inclusive of shipping fee Rs.50/-. (Assume cost of each individual item). All inputs are to be validated based on given condition and exceptions to be thrown accordingly.</p>	3
6	<p><b>Object Oriented Programming in Python</b></p> <p>User convenience becomes the mandatory reason for updates in any industry. Mobile phone industry is fast growing with updated functionalities for every new model. For eg., Earlier model of mobile phones has the provision to store only first name whereas recent mobile phones come with the provision to add firstname, middlename and lastname. But, it's a condition that all mobile phone models should have the provision to store atleast first name.</p> <p>The software for managing user interface should possess the capability to support all the mobile phone models. Assuming that the user interface for mobile phones is designed using JAVA, write a program that can store and display the names in the below format depending upon the input from the user.</p> <p>For eg., if the input is "Wolfgang", then the output will be Wolgnagf.</p> <p>If the input has three strings i.e., Wolfgang, Amadeus, and Mozart, then the output should be WolsuedamAMozart.</p>	3
7	Create a Profile Application Page using any web development tool with database connectivity. The details of the Pages are given below.	

	Registration Page	<div style="text-align: center;"> <h2>Register</h2> <p>Enter Your Username</p> <p>Enter Your Password</p> <p>Enter Your Email ID</p> <p>Enter Your Organisation</p> <p>Enter Your Address</p> <p>Enter Your City</p> <p>Enter Your State</p> <p>Enter Your Country</p> <p>Enter Your Postal Code</p> <p>Register</p> <p>Already have account? <a href="#">Login here</a></p> </div>	
	Index Page	<div style="display: flex; justify-content: space-between;"> <div style="background-color: #333; color: white; padding: 5px;"> <b>SIDE BAR</b>  <a href="#">Index</a>  <a href="#">Display</a>  <a href="#">Update</a>  <a href="#">Log out</a> </div> <div style="text-align: right;"> <p>Welcome!! You are in Index Page!!</p> <p>Logged in successfully!</p> </div> </div>	
	Update page	<div style="display: flex; justify-content: space-between;"> <div style="background-color: #333; color: white; padding: 5px;"> <b>SIDE BAR</b>  <a href="#">Index</a>  <a href="#">Display</a>  <a href="#">Update</a>  <a href="#">Log out</a> </div> <div style="text-align: right;"> <p>Welcome!! You are in Update Page!!</p> <p><b>Fill Your Details to Update</b></p> <p>Enter Your Username</p> <p>Enter Your Password</p> <p>Enter Your Email ID</p> <p>Enter Your Organisation</p> <p>Enter Your Address</p> <p>Enter Your City</p> <p>Enter Your State</p> <p>Enter Your Country</p> <p>Enter Your Postal Code</p> <p>Update</p> </div> </div>	
	Display page	<div style="display: flex; justify-content: space-between;"> <div style="background-color: #333; color: white; padding: 5px;"> <b>SIDE BAR</b>  <a href="#">Index</a>  <a href="#">Display</a>  <a href="#">Update</a>  <a href="#">Log out</a> </div> <div style="text-align: right;"> <p>Welcome!! You are in Display Page!!</p> <p><b>Your Details</b></p> <p>Username: Alex          Password: alex123          Email ID: alex@gmail.com          Organization: Grant University          Address: No. 12, State street          City: Mumbai          State: Maharashtra          Country: India          Postal code: 400022</p> </div> </div>	

	Logout page	LOGGED OUT SUCCESSFULLY																																																																																	
8	<p><b>Visualization – Qualitative and Quantitative Analysis</b>  Design and plot an informative chart(s) for visualizing the comparison between region-wise sales, region-wise profit and region-wise discount of super-store dataset. The plot should have a minimum of five numerical information for better understanding of data. Dataset may be downloaded from <a href="https://www.kaggle.com/juhi1994/superstore">https://www.kaggle.com/juhi1994/superstore</a></p>		6																																																																																
9	<p><b>Numpy and Pandas</b></p> <ol style="list-style-type: none"> <li>1. Download pokeman dataset from <a href="https://www.kaggle.com/rounakbanik/pokemon">https://www.kaggle.com/rounakbanik/pokemon</a> and load it in a dataframe.</li> <li>2. Check for the details of columns and analyse by printing the details of data.</li> <li>3. Check for missing values and if present fill those with the median of each feature.</li> <li>4. Find out the presence of outliers and remove them if present in the data.</li> <li>5. Use boxplot for visualizing the range of values present in the features.</li> <li>6. Visualize the correlation between the various features of the dataset.</li> <li>7. Remove the columns with minimum relationship between each other.</li> <li>8. Use swarmplot for visualization.</li> </ol>		6																																																																																
10	<p><b>Model Implementation</b>  A sample dataset about the various crimes is given below. Develop a suitable model with appropriate machine learning algorithm for a meaningful inference using Python. Justify your selection.</p> <table border="1"> <thead> <tr> <th>Person</th> <th>Murder</th> <th>Assault</th> <th>Urban Pop</th> <th>Theft</th> </tr> </thead> <tbody> <tr><td>P1</td><td>13.2</td><td>236</td><td>58</td><td>21.2</td></tr> <tr><td>P2</td><td>10.0</td><td>263</td><td>48</td><td>44.5</td></tr> <tr><td>P3</td><td>8.1</td><td>294</td><td>80</td><td>31.0</td></tr> <tr><td>P4</td><td>8.8</td><td>190</td><td>50</td><td>19.5</td></tr> <tr><td>P5</td><td>9.0</td><td>276</td><td>91</td><td>40.6</td></tr> <tr><td>P6</td><td>7.9</td><td>204</td><td>78</td><td>38.7</td></tr> <tr><td>P7</td><td>3.3</td><td>110</td><td>77</td><td>11.1</td></tr> <tr><td>P8</td><td>5.9</td><td>238</td><td>72</td><td>15.8</td></tr> <tr><td>P9</td><td>15.4</td><td>335</td><td>80</td><td>31.9</td></tr> <tr><td>P10</td><td>17.4</td><td>211</td><td>60</td><td>25.8</td></tr> <tr><td>P11</td><td>5.3</td><td>46</td><td>83</td><td>20.2</td></tr> <tr><td>P12</td><td>2.6</td><td>120</td><td>54</td><td>14.2</td></tr> <tr><td>P13</td><td>10.4</td><td>249</td><td>83</td><td>24.0</td></tr> <tr><td>P14</td><td>7.2</td><td>113</td><td>65</td><td>21.0</td></tr> <tr><td>P15</td><td>2.2</td><td>56</td><td>57</td><td>11.3</td></tr> </tbody> </table>		Person	Murder	Assault	Urban Pop	Theft	P1	13.2	236	58	21.2	P2	10.0	263	48	44.5	P3	8.1	294	80	31.0	P4	8.8	190	50	19.5	P5	9.0	276	91	40.6	P6	7.9	204	78	38.7	P7	3.3	110	77	11.1	P8	5.9	238	72	15.8	P9	15.4	335	80	31.9	P10	17.4	211	60	25.8	P11	5.3	46	83	20.2	P12	2.6	120	54	14.2	P13	10.4	249	83	24.0	P14	7.2	113	65	21.0	P15	2.2	56	57	11.3	6
Person	Murder	Assault	Urban Pop	Theft																																																																															
P1	13.2	236	58	21.2																																																																															
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P7	3.3	110	77	11.1																																																																															
P8	5.9	238	72	15.8																																																																															
P9	15.4	335	80	31.9																																																																															
P10	17.4	211	60	25.8																																																																															
P11	5.3	46	83	20.2																																																																															
P12	2.6	120	54	14.2																																																																															
P13	10.4	249	83	24.0																																																																															
P14	7.2	113	65	21.0																																																																															
P15	2.2	56	57	11.3																																																																															
<b>Total Instructional hours</b>			<b>45</b>																																																																																

COURSE  
OUTCOME

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

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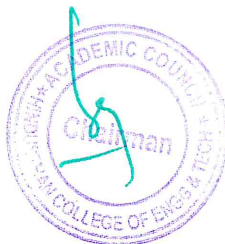
Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2002	DATA STRUCTURES AND ALGORITHMS LAB	0	0	3	1.5

COURSE OBJECTIVE	
	1. To develop C programs using the basic concepts of data structures and algorithms
	2. To Understand concepts about stacks, queues, lists, trees and graphs
	3. To understand concepts about searching and sorting algorithms.
	4. To understanding the various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
	5. To implement applications using these data structures.

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

COURSE OUTCOME	
	CO1: Develop C programs using the basic concepts of data structures and algorithms
	CO2 : Able to implement concepts about stacks, queues, lists, trees and graphs
	CO3 : Able to design searching and sorting algorithms.
	CO4 : Able to use various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
	CO5 : Develop applications using these data structures.

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## PROFESSIONAL ELECTIVE

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

- COURSE OBJECTIVE**
1. Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
  2. Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
  3. Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.
  4. Understand the legal aspects of forensics
  5. Recognize the state of the practice and the gaps in technology, policy, and legal issues.

Unit	Description	Instructional Hours
	<b>DISK FORENSICS</b>	
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
	<b>SOFTWARE FORENSICS</b>	
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
	<b>NETWORK FORENSICS</b>	
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
	<b>CYBER SECURITY INTRODUCTION</b>	
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
	<b>SECURITY INVESTIGATION AND ANALYSIS</b>	
V	Need for Security - Threats - Attacks – Legal - Ethical and Professional Issues -Risk Management- Identifying and assessing - Risk Assessing and Controlling Risk.	9
	<b>Total Instructional Hours</b>	<b>45</b>

- COURSE OUTCOME**
- CO1: Understand and analyze the fundamentals of Disk forensics
  - CO2: Understand and analyze the fundamentals of Software forensics
  - CO3: Understand and analyze the fundamentals of Network forensics
  - CO4: Understand and analyze fundamentals of cyber security and relationship between IT and forensics
  - CO5: Understand and analyze the security investigation

**REFERENCE BOOKS:**

1. Albert J Marcella, et al, Cyber forensics, 2<sup>nd</sup> 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.

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

- COURSE OBJECTIVE**
1. To learn the fundamentals of Green Computing.
  2. To analyze the Green computing Grid Framework.
  3. To understand the issues related with Green compliance.
  4. To understand about the future technology of Green Computing.
  5. To study and develop various case studies.

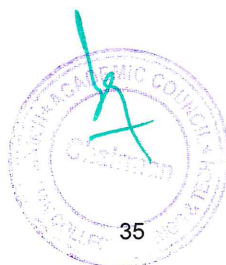
<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>FUNDAMENTALS</b>	
<b>I</b>	Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.	9
	<b>GREEN ASSETS AND MODELING</b>	
<b>II</b>	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
	<b>GRID FRAMEWORK</b>	
<b>III</b>	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
	<b>GREEN COMPLIANCE</b>	
<b>IV</b>	Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	9
	<b>CASE STUDIES</b>	
<b>V</b>	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
<b>Total Instructional Hours</b>		<b>45</b>

- COURSE OUTCOME**
- CO1: Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- CO2: Enhance the skill in energy saving practices in their use of hardware.
- CO3: Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
- CO4: Understand the ways to minimize equipment disposal requirements.
- CO5: To understand the scenarios and strategies of Green computing.

**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, 2008

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

- COURSE OBJECTIVE**
1. Learn the foundations of Human Computer Interaction.
  2. Be familiar with the design technologies for individuals and persons with disabilities. Be aware of mobile HCI.
  3. Learn the guidelines for user interface.
  4. Learn new things about Mobile Frame works and its applications.
  5. To know about the social issues in communication of the day to day life.

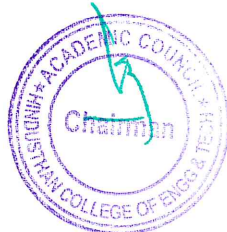
Unit	Description	Instructional Hours
	<b>FOUNDATIONS OF HCI</b>	
I	The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices –Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9
	<b>DESIGN &amp; SOFTWARE PROCESS</b>	
II	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
	<b>MODELS AND THEORIES</b>	
III	Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.	9
	<b>MOBILE HCI</b>	
IV	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
	<b>WEB INTERFACE DESIGN</b>	
V	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	9
<b>Total Instructional Hours</b>		<b>45</b>

- COURSE OUTCOME**
- CO1: Design effective dialog for HCI.  
CO2: Design effective HCI for individuals and persons with disabilities.  
CO3: Assess the importance of userfeedback.  
CO3: Explain 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", 3<sup>rd</sup> 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).

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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 learn about computer ethics in work environment.
  2. To expose the threats in computing environment
  3. To know the intricacies of accessibility issues
  4. To ensure safe exits when designing the software projects
  5. To comprehend the concepts of computer ethics in work environment.

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

- COURSE OUTCOME
- CO1: Remember the human values and computer ethics.
  - CO2: Understand the computer crime and the related intellectual property rights
  - CO3: Apply regulatory and safety concepts in internet.
  - CO4: Understanding the computer technologies.
  - CO5: Remember the models 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](http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm)

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

- COURSE OBJECTIVE**
1. To understand the introductory concepts of HTML
  2. Designing Images with various features using Raster Image Editing Software
  3. Creating Special Effects and Animation using Action Scripts.
  4. Incorporating Multimedia and sound effects in a web Page
  5. Creating an Interactive web site with all utilities

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION</b>	
I	HTML coding - Basic web graphics - Web page design and site building - Image maps - Adding multimedia to the web- Vector and Raster graphics.	9
	<b>RASTER IMAGE EDITING SOFTWARE</b>	
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
	<b>VECTOR IMAGE HANDLING</b>	
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
	<b>MULTIMEDIA</b>	
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
	<b>APPLICATIONS</b>	
V	Creating web site with a particular theme using all the utilities - Graphics - Animations and Interaction.	9
<b>Total Instructional Hours</b>		<b>45</b>

- COURSE OUTCOME**
- CO1: Understand the Concepts of HTML and simple web site creation using HTML  
CO2: Designing web pages using image editing software and its tools  
CO3: Creating Flash web site  
CO4: Correctly explain a variety of terms relating to web design, HTML, CSS, and Flash.  
CO5: Design, create, and upload an original website.

**REFERENCE BOOKS:**

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 Taylorand Francis group, 2013
3. Andrew Faulkner, Conrad ChavezAdobe Photoshop CC Classroom in a Book (2017 release)

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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 understand the fundamentals of Boolean logic and functions.
2. To design and realize digital systems with basic gates and other components using combinational and sequential circuits.
3. To study the instruction sets and operations of a processor.
4. To study the different ways of communication with I/O devices and standard I/O Interfaces.
5. To study the hierarchical memory system including cache memories and virtual memory.

Unit	Description	Instructional Hours
	<b>DIGITAL FUNDAMENTALS</b>	
I	Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.	9
	<b>COMBINATIONAL AND SEQUENTIAL CIRCUITS</b>	
II	Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters	9
	<b>COMPUTER FUNDAMENTALS</b>	
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
	<b>PROCESSOR</b>	
IV	Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
	<b>MEMORY AND I/O</b>	
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
<b>Total Instructional Hours</b>		<b>45</b>

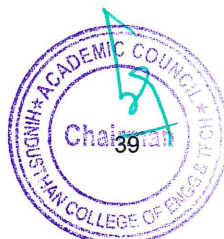
**COURSE OUTCOME**

- CO1: Be proficient in number systems and computer arithmetic.  
 CO2: Design and implement digital systems with basic gates and other components using combinational and sequential circuits.  
 CO3: Familiarize and understand the organization of memory hierarchies including the basics of cache design and subsystem.  
 CO4: Understand a machine's Instruction Set Architecture (ISA) including basic instruction fetch and execute cycles, instruction formats and control flow.  
 CO5: Understand a basic input/output functioning including program controlled I/O, 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.

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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**

- To understand phases of activities in the models of E-learning.
- To understand appropriate instructional methods and delivery strategies
- To understand and choose appropriate E-learning authoring tools.
- To understand interactive E-Learning Platforms.
- To understand the E-learning course delivery and evaluation methods.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and A synchronous 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
	<b>DESIGNING E-LEARNING COURSE CONTENT</b>	
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
	<b>CREATING INTERACTIVE CONTENT</b>	
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–Courseware Development–Authoring Tools–Types of Authoring Tools–Selecting an Authoring Tool.	9
	<b>LEARNING PLATFORMS</b>	
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
	<b>COURSE DELIVERY AND EVALUATION</b>	
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
<b>Total Instructional Hours</b>		<b>45</b>

**COURSE OUTCOME**

- CO1: Distinguish the phases of activities in the models of E-learning.
- CO2: Identify appropriate instructional methods and delivery strategies.
- CO3: Choose appropriate E-learning authoring tools.
- CO4: Create interactive E-Learning Platforms
- CO5: Evaluate and Manage the E-learning course delivery and evaluation methods.

**REFERENCE BOOKS:**

- R1. Clark, R.C. and Mayer, R.E, “e-Learning and the Science of Instruction”, Third Edition, John Wiley, 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”, Educause Review, 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.

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

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

**COURSE OUTCOME**

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

**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.

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# **SYLLABUS**

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

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

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

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

**REFERENCE BOOKS:**

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

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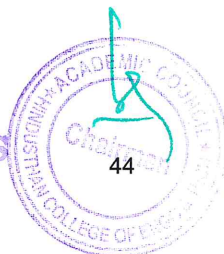
  
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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3202	OPERATING SYSTEMS	3	1	0	4

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

Unit	Description	Instructional hours
I	<p><b>OS INTRODUCTION AND PROCESS MANAGEMENT AND SCHEDULING ALGORITHMS</b></p> <p><b>Introduction:</b> Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, System Calls, Operating System Structure</p> <p><b>Processes:</b> Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.</p> <p><b>Process Scheduling:</b> Basic concepts of scheduling, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.</p> <p><b>Scheduling algorithms:</b> Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling</p> <p><b>PROCESS SYNCHRONIZATION, THREADS AND DEADLOCKS</b></p> <p><b>Inter-process Communication:</b> 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 &amp; Writer Problem, Dining Philosopher Problem</p>	12
II	<p><b>Concurrent Programming:</b> Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.</p> <p><b>Thread:</b> Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.</p> <p><b>Deadlocks:</b> Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.</p> <p><b>MEMORY MANAGEMENT</b></p> <p><b>Memory Management:</b> Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction.</p>	12
III	<p><b>Virtual Memory:</b> 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).</p> <p><b>FILE SYSTEMS MANAGEMENT, I/O AND DISK MANAGEMENT</b></p> <p><b>File Management:</b> Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.</p> <p><b>I/O Hardware:</b> I/O devices, Device controllers, Direct Memory Access, Principles of I/O.</p> <p><b>Disk Management:</b> Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.</p> <p><b>VIRTUAL MACHINES AND CASE STUDY</b></p> <p>History, Benefits and Features, Building Blocks – Types of Virtual Machines – Virtualization and Operating System Components – VMware</p> <p><b>Case study:</b> UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.</p>	12
IV		12
V		12

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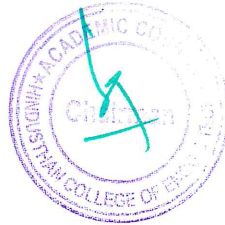
**Total Instructional hours 60**

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

**REFERENCES BOOKS:**

- R1. Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley, 10th Edition, 2019.
- R2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
- R3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces, Arpaci-Dusseau Books, Inc (2015).
- R4. 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	20CA3203	WEB DEVELOPMENT	3	1	0	4

**COURSE OBJECTIVE**

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

Unit	Description	Instructional Hours
	<b>J2EE PLATFORM</b>	
I	Introduction - J2EE Architecture – Containers- J2EE Standard Services – J2EE Technologies-Using JNDI/JNDI Naming Context- Java and LDAP - LDAP operations – LDAP Information Model-LDAP Naming Model.	12
	<b>JSP</b>	
II	Basics of HTML, Introduction to JSP - Life cycle- Implicit objects & scopes- Directives- Scripting elements- Actions- JSTL & Tag library.	12
	<b>MICRO SERVICES IN SPRING BOOT</b>	
III	Micro Services- Design Considerations- Cloud- Cloud Config- Netflix- Fault Tolerance Concepts- API Gateway- Messaging Queue Concepts- Oauth2 Concepts- Swagger API- Cloud Hosting.	12
	<b>REACT JS BASICS</b>	
IV	Environment setup- JSX- Components- State- Props overview & validation- Component API & Lifecycle.	12
	<b>REACT JS ADVANCED</b>	
V	Forms- Events- Refs- keys- Router- Flux concept- Using flux- Animations- Higher order components	12
<b>Total Instructional Hours</b>		<b>60</b>

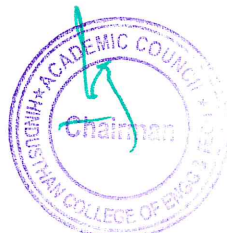
**COURSE OUTCOME**

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

**REFERENCES:**

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

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

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

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

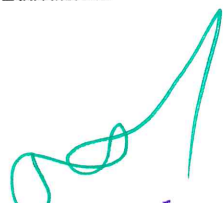
- COURSE OUTCOME
- CO1: Acquire the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents
- CO2: Able to Understand various machine learning algorithms used in Artificial Intelligence.
- CO3: knowledge of fundamental concepts of NLP
- CO4: Acquired the fundamental knowledge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

**REFERENCE BOOKS:**

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

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

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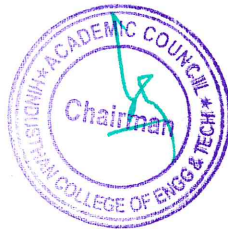
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|----|--|
| 1. | Students shall develop creative or innovative project.               |
| 2. | Need to submit a report, presentation with demo.                     |
| 3. | User Based Testing and feedback from the benefited society required. |

**Total Practical Hours      45**

**COURSE OUTCOME**

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

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

COURSE OBJECTIVE

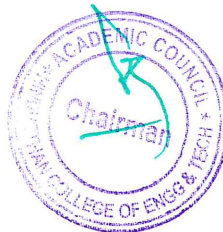
CO1: To know about the spring frame work.  
CO2: To develop conceptual understanding of database management system  
CO3: To understand the real-world applications by using spring technology  
CO4: To design and understanding the ReactJS concepts  
CO5: To understand the concepts of data transfer via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

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

COURSE OUTCOME

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

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**PROFESSIONAL ELECTIVE**

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

**COURSE OBJECTIVE**

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

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO BLOCKCHAIN</b>	
I	History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain –Blockchain and Full Ecosystem Decentralization–Platforms for Decentralization.	9
	<b>INTRODUCTION TO CRYPTOCURRENCY</b>	
II	Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments –Wallets–Alternative Coins–Theoretical Limitations–Bitcoin limitations–Namecoin–Primecoin –Zcash–Smart Contracts–Ricardian Contracts.	9
	<b>ETHEREUM</b>	
III	The Ethereum Network–Components of Ethereum Ecosystem–Ethereum Programming Languages: Runtime By teCode, Blocks and Blockchain, Fee Schedule–Supporting Protocols–Solidity Language	9
	<b>WEB3 and HYPERLEDGER</b>	
IV	Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as Protocol–The Reference Architecture–Hyperledger Fabric–Distributed Ledger–Corda.	10
	<b>ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS</b>	
V	Kadena–Ripple–Rootstock–Quorum–Tendermint–Scalability–Privacy–Other Challenges–Blockchain Research– Notable Projects –Miscellaneous Tools	8
<b>Total Instructional Hours</b>		<b>45</b>

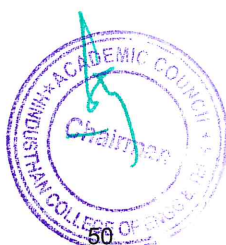
**COURSE OUTCOME**

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

**REFERENCE BOOKS:**

- R1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", 2<sup>nd</sup> Edition, Packt Publishing, 2018.
- R2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-on Approach", VPT Publisher, 2017.
- R3. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
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- R5. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
- R6. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017.

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

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

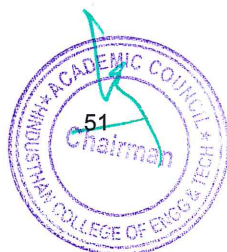
Unit	Description	Instructional Hours
	<b>COMPUTING PARADIGMS</b>	
I	High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.	9
	<b>CLOUD COMPUTING FUNDAMENTALS</b>	
II	Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models	9
	<b>CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT</b>	
III	Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration	9
	<b>CLOUD SERVICE MODELS</b>	
IV	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
	<b>CLOUD SERVICE PROVIDERS</b>	
V	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
<b>Total Instructional Hours</b>		<b>45</b>

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

**REFERENCE BOOKS:**

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

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

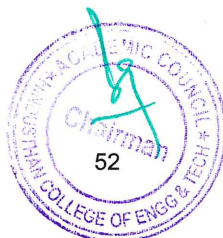
Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3303	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

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

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

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

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**REFERENCES BOOKS:**

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

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

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

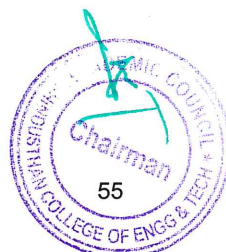
<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>BASICS OF NEURAL NETWORKS</b>	
I	Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Back propagation Networks.	9
	<b>INTRODUCTION TO DEEP LEARNING</b>	
II	Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation 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
	<b>CONVOLUTIONAL NEURAL NETWORKS</b>	
III	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
	<b>ADDITIONAL DEEP LEARNING ARCHITECTURES</b>	
IV	Long Short-Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders – Representation Learning – Deep generative Models – Deep Belief Networks – Deep Generative Networks – Generative Schemes – Evaluating Generative Models.	9
	<b>APPLICATIONS OF DEEP LEARNING</b>	
V	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
	<b>Total Instructional Hours</b>	<b>45</b>

- COURSE OUTCOME**
- CO1: Understand the role of deep learning in machine learning applications.  
CO2: Get familiar with the use of TensorFlow and Keras in deep learning applications.  
CO3: Design and implement deep learning applications.  
CO4: Critically analyze different deep learning models in image related projects.  
CO5: Design and implement convolutional neural networks and know about applications of deep learning in NLP and image processing.

**REFERENCE BOOKS:**

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

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

**COURSE OBJECTIVE**

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

Unit	Description	Instructional Hours
I	<b>INTRODUCTION</b> Information technology and Business-E-Commerce-EDI-E-Commerce types-E-Commerce and World Wide Web-Internet Connectivity-E-Commerce – case studies leading the Transformation-E-Governance case studies leading the Transformation – - Internet communication protocols-Internet services and Resources-Internet Mail-Internet search-issues of concern-Browsers-HTML Java-Internet 2	9
II	<b>BUILDING BLOCKS FOR E-COMMERCE</b> 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	<b>CYBER SECURITY</b> 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	<b>IT ACT 2000</b> Trust in the Electronic environment-electronic authentication-paper-vs electronic world-The IT act 2000-cybercrimes under the IT act.	9
V	<b>CASE STUDIES</b> E-Commerce Case Studies- E-Commerce in India- Indiatimes.com-Rediff.com-Bazee.com-Steel Authority of India-Amul- the taste of India	9
<b>Total Instructional Hours</b>		<b>45</b>

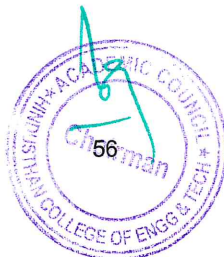
**COURSE OUTCOME**

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

**REFERENCE BOOKS:**

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

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

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

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	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
	<b>AR &amp; MR COMPUTING ARCHITECTURE</b>	
II	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
	<b>MR MODELING</b>	
III	Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling–TransformationMatrices–ObjectPosition–TransformationInvariants– ObjectHierarchies–ViewingThe3DWorld–PhysicalModeling–CollisionDetection–Surface Deformation–ForceComputation–ForceSmoothingAndMapping–BehaviorModeling– ModelManagement.	9
	<b>MR PROGRAMMING</b>	
IV	VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of WorldToolkitandJava3D – GHOST–People Shop–Human Factors in VR–Methodology and Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding – Trajectories through Mixed Reality Performance–Mobile Interface Design–Quantitative Evaluation–Qualitative Evaluation.	9
	<b>APPLICATIONS</b>	
V	Medical Applications of MR–Education, Arts and Entertainment–Military Applications–Emerging Applications of MR–MR Applications in Manufacturing–Applications of MR in Robotics– Information Visualization–Wearable Computing–Games	9
	<b>Total Instructional Hours</b>	<b>45</b>

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

**REFERENCE BOOKS:**

- R1. Grigore C.Burdea,PhilipCoiffet,“VirtualRealityTechnology”, Second Edition,WileyIndia,2017.  
R2. Benford, S., GiannachiG., “PerformingMixedReality”, MITPress,2011.  
R3. CharlesPalmer,JohnWilliamson, “VirtualRealityBlueprints:CreateCompellingVRExperiencesforMobile”, Packt Publisher, 2018.  
R4. JasonJerald, “TheVRBook: Human-CenteredDesignforVirtualReality” Association forComputing Machinery and Morgan, ClaypoolPublishers,2015  
R5. William R. Sherman, Alan B.Craig: Understanding Virtual Reality – Interface, Application,Design”,Morgan Kaufmann, 2003  
R6.KellyS.Hale,KayM.StanneyHandbookofVirtualEnvironments:Design,Implementation,andApplications,Seco ndEdition,CRCpress,2014

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

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

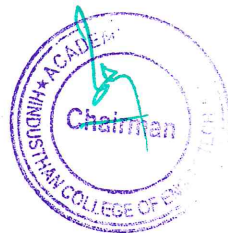
Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Manager's functions, roles and skills. Organizational behavior: Definition – contributing disciplines - challenges and opportunities – Developing an OB Model - Organizational behaviour models. Organization structure: key elements – common organizational designs - determinants.	9
	<b>INDIVIDUAL BEHAVIOUR</b>	
II	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
	<b>GROUP BEHAVIOUR</b>	
III	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
	<b>LEADERSHIP AND POWER</b>	
IV	Leadership: Meaning – trait theories, behavioural theories, contingency theories. Power – bases of power – power tactics. Politics – causes and consequences. Impression Management.	9
	<b>ORGANIZATIONAL CULTURE AND DYNAMICS</b>	
V	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
	<b>Total Instructional Hours</b>	<b>45</b>

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

**REFERENCE BOOKS:**

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

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

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

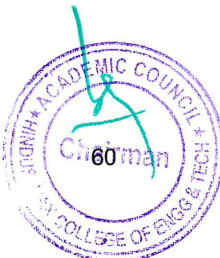
<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>RESEARCH PROBLEM FORMULATION</b>	
I	Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations.	9
	<b>LITERATURE REVIEW</b>	
II	Effective literature studies approaches, analysis, plagiarism, and research ethics.	9
	<b>TECHNICAL WRITING /PRESENTATION</b>	
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
	<b>INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)</b>	
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
	<b>INTELLECTUAL PROPERTY RIGHTS (IPR)</b>	
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
<b>Total Instructional Hours</b>		<b>45</b>

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

**REFERENCE BOOKS:**

- R1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
- R2. Kothari, C.R. (2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi.
- R3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.
- R4. Gupta S.P. (2008). Statistical Methods. 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

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

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

Unit	Description	Instructional Hours
I	<b>THE QUEST FOR SEMANTICS</b> Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.	9
II	<b>LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES</b> 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	<b>ONTOLOGY LEARNING FOR SEMANTIC WEB</b> 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	<b>ONTOLOGY MANAGEMENT AND TOOLS</b> 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	<b>APPLICATIONS</b> 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
<b>Total Instructional Hours</b>		<b>45</b>

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

**REFERENCES BOOKS:**

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

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

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

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

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

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

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

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

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

**Course Code & Name**      21CA1171      Communicative Skill for Business  
English

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

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

**Academic Year 2021 - 2022 - Semester – II - Btch 2021 - 2023**

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

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

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

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

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

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

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

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

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

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

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

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

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

**Academic Year 2021 - 2022 - Semester – II - Btch 2021 - 2023 - List of Electives**

Course Code & Name		21CA2301 Cyber Security												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	0	0	0	0	2	0	0	2	0	0	0	0	1
Average	2	0	0	0	0	2	0	0	2	0	0	0	0	1

Course Code & Name		21CA2302 Green Computing												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2	1	1	2	0	2	2	0	2	2	0	0	0	3
Average	2	0.2	0.2	0.4	0	2	0.4	0	2	0.4	0	0	0	1.4

Course Code & Name		21CA2303 Human Computer Interaction												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.2	1.75	1.75	1.2	1	1.2	1.2	1	1.2	1.2	1	1	1	1.4

Course Code & Name		21CA2304 Professional Ethics												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	3	3	1	3	3	1	3	3	3	3	2
CO2	1	2	2	1	2	1	1	2	1	1	2	2	2	0
CO3	3	0	0	1	3	3	1	3	3	1	3	3	3	2
CO4	0	0	0	0	2	0	0	2	0	0	2	2	2	0
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	1.6	1.6	1.6	1.6	2	1.6	1.6	2	1.6	1.6	2	2	2	1.4

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

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

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

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

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

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

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

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

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

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

**Course Code & Name      20CA3201      Big Data Analytics**

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

**Course Code & Name      20CA3202      Operating Systems**

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

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**Course Code & Name      0CA3203      Web Development**

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

**Course Code & Name      20CA3204      Artificial Intelligence**

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





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

**Course Code & Name      20CA3304      Deep Learning**

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

**Course Code & Name      20CA3305      E-Commerce**

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

**Course Code & Name      20CA3306      Mixed Learning**

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

**Course Code & Name      20CA3307      Organizational Behaviour**

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

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

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

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

**Academic Year 2021 - 2022 - Semester – I - Batch 2021 - 2023**

**Mapping of Course Outcome and Programme Outcome:**

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

**Academic Year 2021 - 2022 - Semester – II - Btch 2021 - 2023**

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

**Academic Year 2021 - 2022 - Semester – II - Btch 2021 - 2023 - List of Electives**

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

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

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

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

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



**BoS Chairman**



**Dean Academics**