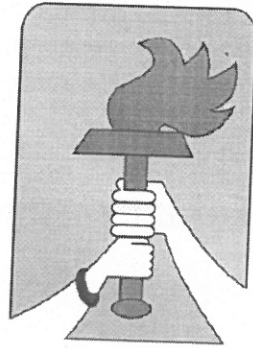**HINDUSTHAN**
EDUCATIONAL AND CHARITABLE TRUST

HICET

HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF COMPUTER APPLICATIONS

Revised Curriculum and Syllabus for the Batch 2021-2023

(Academic Council Meeting Held on 30.08.2022)

2020 REGULATIONS

HindusthanCollegeofEngineering andTechnology
(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, NewDelhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.

HINDUSTHAN
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CERTIFIED

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

POSTGRADUATE PROGRAMMES

MCA. COMPUTER APPLICATIONS(PG)

REGULATION-2020 (Revised on August 2022)

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

SEMESTER I – BRIDGE COURSE

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

SEMESTER I – REGULAR COURSE

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

SEMESTER II – BRIDGE COURSE

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

SEMESTER II – REGULAR COURSE

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

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21CA3203R	Web Development	PC	3	1	0	4	40	60	100
2.	21CA3205	Cryptography and Network Security	IC	3	1	0	4	40	60	100
3.	21CA3251	Data Science and Analytics	PC	3	0	2	4	50	50	100
4.	21EC3251	Internet of Things	PC	2	0	2	3	50	50	100
5.	21CA33XX	Professional Elective -I/ NPTEL / EDX	PE	3	0	0	3	40	60	100
6.	21CA3571	L/S/MOOC	EEC	2	0	0	2	100	---	100
PRACTICAL										
7.	21CA3001	Mini Project Lab	EEC	0	0	3	1.5	60	40	100
8.	21CA3002R	Web Development Lab	EEC	0	0	3	1.5	60	40	100
			Total	17	3	6	23	440	360	800

SEMESTER IV

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

LIST OF PROFESSIONAL ELECTIVES

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

CREDIT DISTRIBUTION

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

Chairman, Board of Studies   Dean - Academics   Principal

SEMESTER –III

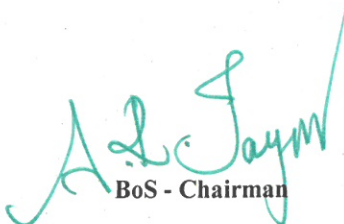| Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3203R	WEB DEVELOPMENT	3	1	0	4

COURSE OBJECTIVE	1. To acquire knowledge on the usage of recent platforms in developing web applications 2. To design applications using Servlet, JSP, Spring, ReactJS andNode.js. 3. To understand framework of J2EE, Servlet, JSP, Spring, ReactJS and Node.js. 4. To develop interactive, client-side, server-side executable web applications. 5. To implement database connectivity in Node.js handling the JDBC using spring

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

COURSE OUTCOME	CO1: Make use of the recent platforms in developing web applications CO2: Design applications using J2EE, Servlet, JSP, Spring, ReactJS and Node.js. CO3: Associate an application with external data and deploy it on server. CO4: Build interactive, client-side, server-side executable web applications CO5: Construct database connectivity in Node.js.

REFERNCES:

R1: Iuliana Cosmina , Rob Harrop ,Chris Schaefer ,Clarence Ho "Pro Spring 5 -An In-Depth Guide to the Spring-Frame work and Its Tools "-Fifth Edition –APRESS,2017

R2: Craig Walls, "Spring in Action, 4th Edition Kindle Edition, Manning Publication, 2015.

R3:JobineshPurushothaman, "RESTful Java Web Services" Second Edition, Packt Publishing, 2015

R4: Robin Wieruch -The Road to React "Your journey to master plain yet pragmatic React",2016

R5: Cory Gackenheimer "Introduction to React"-Published by Apress-2015

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3205	CRYPTOGRAPHY AND NETWORK SECURITY	3	1	0	4

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

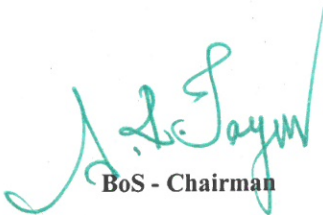| Unit	Description	Instructional Hours
I	**INTRODUCTION** Unit-1: Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security atMultiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSIsecurityarchitecture– Classicalencryptiontechniques:substitutiontechniques,transpositiontechniques,steganography- Foundations of moderncryptography: perfect security–information theory– productcryptosystem–cryptanalysis.	12
II	**SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY** Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.	12
III	**AUTHENTICATION APPLICATIONS** Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.	12
IV	**IP Security** IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.	12
V	**Intruders** Intruders, Intrusion Detection, Password Management. Malicious Software: Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.	12
	Total Instructional Hours	60

COURSE OUTCOME	CO1: 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.

REFERENCE BOOKS:
R1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
R2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
R3. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007
R4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2
R5. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.

R6. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.

R7. William Stallings, "Network Security Essentials Applications and Standards", Third Edition, Pearson Education, 2008.

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

COURSE OBJECTIVE	1. Gain a Historical perspective of Data Science and Analytics and its foundations 2. Become familiar with different types of data and Exploratory Data Analysis and its implementation methods 3. Gain knowledge to experiment with Machine Learning models for Analysis 4. To Gain knowledge on various modeling Techniques. 5. To Learn the basic and Advanced Features of Open Source Big Data Tools and Frameworks

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

COURSE OUTCOME	CO1: To have insight into methods in Data Science and Analytics and familiar with the Statistics and probability concepts.
	CO2 :To develop applications by applying exploratory data Analysis with the modern tools.
	CO3: To conduct Investigations on Complex Computing problems by applying various Machine Learning Algorithms.
	CO4: To Identify and design modeling of large data.
	CO5: To work with Big data Platform and data Analytical Frameworks.

REFERENCE BOOKS:

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

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

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

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

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

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

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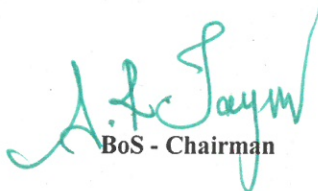Principal / Dean – Academics

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

Sl. No.	Description of the Experiments	
1.	Students shall develop creative or innovative project.	
2.	Need to submit a report, presentation with demo.	
3.	User Based Testing and feedback from the benefited society required.	
	Total Practical Hours	**45**

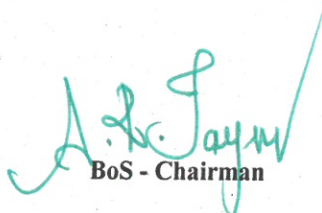| COURSE OUTCOME	CO1: Develop skill to create practical solutions to identified problem. CO2: Use software lifecycle model and other artifacts appropriate for problem. CO3: Identify and master tools required for the project. CO4: Plan and work systematically towards completion of a project work. CO5: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

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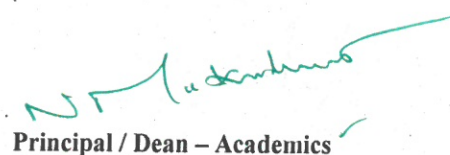| Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3002R	WEB DEVELOPMENT LAB	0	0	3	1.5

COURSE OBJECTIVE	1.To apply the concepts of servlet in real life applications. 2.To build programs to using JSP 3. To construct programs to use ReactJS components. 4. To develop programs to access database using Node.js. 5. To implement MongoDB in Node.js.

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

Course Outcome	CO1: Able to create program for the client and server technologies using servlet CO2: Able towriteapplications-oriented web services using JSP CO3: Ableto develop the dependencies by using ReactJS CO4: Ableto build programs using react components CO5: Able to construct database connectivity using Node.js

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PROFESSIONAL ELECTIVE

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

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

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

COURSE OUTCOME	CO1: Students will understand the basic accounting concepts and preparation of financial statements CO2: Students will understand the various techniques in financial statement analysis CO3: Students will understand the analysis of fund flow and cash flow and application of cost accounting technique to ascertain the cost of products and services CO4: Students will understand the application of marginal·costing techniques, preparation and presentation of budgets in business CO5: Students will understand concept of financial management, time value of money and investment decision on projects.

REFERENCE BOOKS:

1.R.S.N. Pillai and V.Bagavathi, Financial Accounting, S.Chand publishing, New Delhi 2019.

2.R.S.N. Pillai and V.Bagavathi, Cost Accounting, S.Chand publishing, New Delhi 2019

3. M Y Khan and P K Jain, Financial Management– Text, Problems and Cases, Tata McGraw Hill, New Delhi 2019.

4. John J.Hampton, —Financial Decision Making –Concepts, Problems and Casesl Prentice Hall of India (P) Ltd., New Delhi, 2019

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3302	CLOUD COMPUTING	3	0	0	3

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

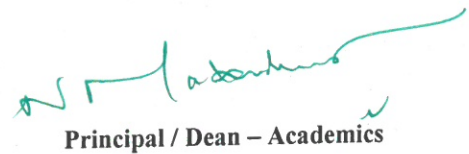| Unit	Description	Instructional Hours
I	**INTRODUCTION: Computing Paradigms** High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing. **Cloud Computing Fundamentals** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Principles of Cloud computing, Essential Characteristics, Deployment Models	9
II	**CLOUD COMPUTING ARCHITECTURE AND** MANAGEMENT Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud, Phases of Cloud Migration	9
III	**CLOUD SERVICE MODELS** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.	9
IV	**CLOUD SERVICE PROVIDERS** EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud	9
V	**Cloud Computing Software Security fundamentals**: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering	9
	Total Instructional Hours	45

COURSE OUTCOME	**CO1:** Use Distributed systems in Cloud Environment. **CO2:** Understandability of concepts, key technologies, pros and cons of Cloud computing. **CO3:** Recognize the Architecture, basic structure and models of Cloud computing. **CO4:** Adopt and use the suitable current technology for the implementation of Cloud. **CO5:** Analyze the core issues of cloud computing such as security, privacy, and interoperability.

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, Geoffery C.Fox, Jack J.Dongarra, Elsevier,2012.

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

4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security AComprehensive Guide to secure CloudComputing" Wiley.

5. John W. Rittinghouse James F.Ransome, "Cloud Computing Implementation, Management and Security" , CRC Press.

6. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer

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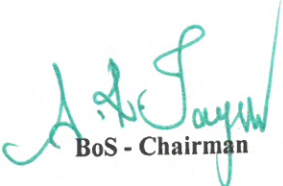| Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3303	SOFT COMPUTING TECHNIQUES	3	0	0	3

COURSE OBJECTIVE	1. To gain knowledge of soft computing theories and its fundamentals. 2. To design a soft computing system required to address a computational task. 3. To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and geneticalgorithms in problem solving and use of heuristics based on human experience. 4. To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neuralnetworks that can learn from available examples and generalize to form appropriate rulesfor inferencing systems. 5. To familiarize with genetic algorithms and other random search procedures while seekingglobal optimum in self – learning situations

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

COURSE OUTCOME	CO1: Identify and describe soft computing techniques and their roles in building intelligent machines. CO2: Recognize the feasibility of applying a soft computing methodology for a particular problem. CO3: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. CO4: Apply genetic algorithms to optimization problems. CO5: Design neural networks to pattern classification and regression problems using a soft computing approach.

REFERENCES BOOKS:

1. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", PearsonEducation, 2004.
2. S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Systems andEvolutionary Algorithms: Synthesis and Applications", PHI Learning, 2nd Edition, 2017.
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Third Edition, Wiley,2018.
4. Simon Haykin, "Neural Networks and Learning Machines", Pearson, 3rd Edition, 2009.
5. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 4th Edition2016.

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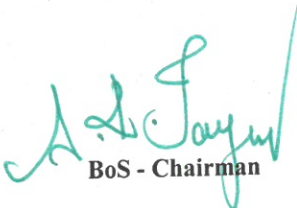| Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3304	DEEP LEARNING	3	0	0	3

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

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

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
		E-COMMERCE	3	0	0	3
MCA	21CA3305					

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

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

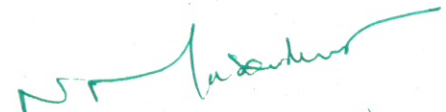|	
COURSE OUTCOME	CO1: Comprehend the underlying economic mechanisms and driving forces of E-Commerce; CO2: Understand the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders; CO3: Appraise the opportunities and potential to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

REFERENCE BOOKS:

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

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

COURSE OBJECTIVE	1. To understand thebasicconceptsof Mixed Reality. 2. To design and develop the Mixed Reality applications in different domains. 3. To Design various models using modelling techniques. 4. To PerformMixedRealityProgrammingwithtoolkits. 5. ToEvaluatemixed reality-based applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION** IntroductiontoVirtualReality (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 –HumanVisual System – Personal Graphics Displays – Large Volume Displays – Sound Displays –HumanAuditorySystem.	9
II	**AR & MRCOMPUTINGARCHITECTURE** Computing Architectures of VR –Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures – Multi-pipelineSynchronization–ARArchitecture - Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	9
III	**MRMODELING** Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling–TransformationMatrices–ObjectPosition–TransformationInvariants– ObjectHierarchies–ViewingThe3DWorld–PhysicalModeling–CollisionDetection–Surface Deformation–ForceComputation–ForceSmoothingAndMapping–BehaviorModeling– ModelManagement.	9
IV	**MR PROGRAMMING** VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of World Tool kit and Java3D – GHOST – People Shop – Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding – Trajectories through Mixed Reality Performance – Mobile Interface Design – Quantitative Evaluation – Qualitative Evaluation.	9
V	**APPLICATIONS** Medical Applications of MR – Education, Arts and Entertainment – Military MR Applications – Emerging Applications of MR –MR Applications in Manufacturing – Applications of MR in Robotics – Information Visualization – Wearable Computing – Games	9
	Total Instructional Hours	45

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

REFERENCE BOOKS:

R1. Grigore C. Burdea, Philip Coiffet, "Virtual Reality Technology", Second Edition, Wiley India, 2017.

R2. Benford, S., GiannachiG., "Performing Mixed Reality", MIT Press, 2011.

R3. Charles Palmer,John Williamson, "Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile", Packt Publisher, 2018.

R4. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality" Association for Computing Machinery and Morgan, Claypool Publishers, 2015

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

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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3307	ORGANIZATIONAL BEHAVIOR	3	0	0	3

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

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

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA3308	RESEARCH METHODOLOGY	3	0	0	3

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

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

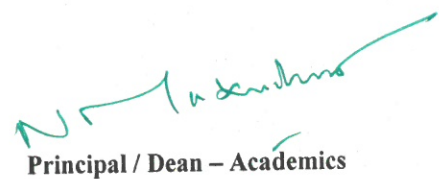|	
COURSE OUTCOME	CO1. Ability to formulate research problem CO2. Ability to carry out research analysis CO3. Ability to follow research ethics CO4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity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

REFERENCE BOOKS:

R1. Garg. B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

R2. Kothari, C.R.(2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi.

R3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.

R4. Gupta S.P. (2008). Statistical Methods. 37th ed. (Rev)Sultan Chand and Sons. New Delhi. 1470 p.

R5. Leon & Leon (2202). Internet for everyone, Vikas Publishing House.

R6. Wadehra, B.L.2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

R7. Research Methodology Dr P M Bulakh, Dr P. S. Patki and Dr A S Chodhary 2010 Published bv Expert Trading Corporation Dahisar West, Mumbai 400068

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

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

Unit	Description	Instructional Hours
I	**THE QUEST FOR SEMANTICS** Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.	9
II	**LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES** Web Documents in XML – RDF – Schema – Web Resource Description using RDF – RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics – Traditional Ontology Languages – LOOM – OKBC – OCML – FLogic Ontology Markup Languages – SHOE – OIL – DAML + OIL – OWL	9
III	**ONTOLOGY LEARNING FOR SEMANTIC WEB** Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Methods for Evaluating Ontologies	9
IV	**ONTOLOGY MANAGEMENT AND TOOLS** Overview – Need for Management – Development Process – Target Ontology – Ontology Mapping – Skills Management System – Ontological Class – Constraints – Issues, Evolution – Development Of Tools And Tool Suites – Ontology Merge Tools – Ontology Based Annotation Tools.	9
V	**APPLICATIONS** Web Services – Semantic Web Services – Case Study for Specific Domain – Security Issues – Web Data Exchange and Syndication - Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format	9
	Total Instructional Hours	45
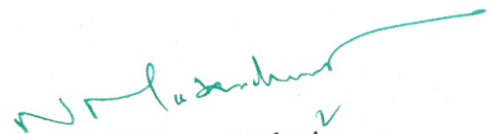
COURSE OUTCOME	CO1: Create ontology for a given domain. CO2: Develop an application using ontology languages and tools. CO3: Understand the concepts of semantic web. CO4: Use ontology related tools and technologies for application creation. CO5: Design and develop applications using semantic web.

REFERENCES BOOKS:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.

2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with Examples from the Areas of Knowledge Management, Ecommerce and the Semantic Web", Springer, 2004.

3. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004.

4. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.

5. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley, 2003.

6. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley, 2006.

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COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF COMPUTER APPLICATIONS

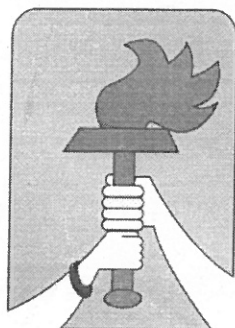**Revised Curriculum and Syllabus for the Batch 2022-2024**

(Academic Council Meeting Held on 30.08.2022)

2020 REGULATIONS

Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, NewDelhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.

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DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCSPATTERN

POSTGRADUATE PROGRAMMES

MCA. COMPUTER APPLICATIONS (PG)

REGULATION-2020 (Revised on August 2022)

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

SEMESTER I – BRIDGE COURSE

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

SEMESTER I – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	21MAI101	Probability And Statistics, Operations Research	FC	3	1	0	4	40	60	100
2.	21CA1251	UI Design & Development	PC	3	0	2	4	50	50	100
3.	21CA1202	Computer Networks	PC	3	0	0	3	40	60	100
4.	21CA1203R	Java Programming	IC	3	1	0	4	40	60	100
5.	21CA1204	Database Management Systems	IC	3	0	0	3	40	60	100
PRACTICAL										
6.	21CA1001R	Java Programming Lab	EEC	0	0	3	1.5	60	40	100
7.	21CA1002	DBMS Lab	EEC	0	0	3	1.5	60	40	100
8.	21CA1171	Communicative Skill for Business English	EEC	0	0	2	2	100	---	100
			Total	15	3	8	23	430	370	800

CREDIT DISTRIBUTION

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

Chairman, Board of Studies   Dean - Academics   Principal

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SEMESTER I- BRIDGE COURSE
ODD SEM

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

Unit	Description	Instructional hours
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	9
III	Evolution of OOP Languages – Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings- Function Overloading - Operator Overloading - Dynamic Memory Management	9
IV	Classes and Objects -Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator- Constants - Static Members - friend Function and friend Class	9
V	Overloading Operator for User Defined Types-Namespace -Inheritance -Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions – Template -Closing Comments	9
	Total Instructional hours	**45**

REFERENCES:

R1. 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	-

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

REFERENCE BOOKS :

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

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

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
7.	Write a C++ program to perform String Concatenation • using Arrays • Using Functions • Using Arrays & functions • Using Pointers & Functions	3
8.	Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading.	6
9.	Write a program to Illustrate Friend Function and Friend Class.	3
10.	Write C++ Programs and incorporating various forms of Inheritance.	3
11.	Write a C++ Program to illustrate Virtual functions	3
	Total Instructional hours	**45**

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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
I	**PROBABILITY AND RANDOM VARIABLE** Definition – Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem (with out proof) -Random variable –Discrete and continuous random variables – Moment generating functions.	12
II	**TESTING OF HYPOTHESES** Sampling distributions -Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions -Tests for Independence of attributes and Goodness of fit.	12
III	**LINEAR PROGRAMMING MODELS** Mathematical Formulation of LPP- Graphical method– Simplex method – Artificial variable Techniques- Sensitivity analysis.	12
IV	**TRANSPORTATION AND ASSIGNMENT MODELS** Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm.	12
V	**SCHEDULING BY PERT AND CPM** Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.	12
	Total Instructional Hours	60

COURSE OUTCOME	CO1: 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, 2nd Edition, New Delhi, 2010.
2. Taha H.A., "Operations Research: An Introduction "8th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

R1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.

R2. Man Mohan, Kanti Swarup, P. K. Gupta, "Introduction to Management Science Operations Research" Sultan
Chand & Sons, 2014.
R3. A.M. Natarajan, Balasubramanian, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1251	UI DESIGN AND DEVELOPMENT	3	0	2	4

COURSE OBJECTIVE	1. To understand the concepts and architecture of the World Wide Web. 2. To understand and practice mark-up languages. 3. To understand and practice embedded dynamic scripting on client-side Internet Programming. 4. To understand and practice web development techniques on client-side. 5. To understand and develop design rich client presentation.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP Request – Response. Introduction HTML – HTML Elements – Semantics – Attributes –Headings-Paragraph-Styles – Formatting – Quotations – Computer Code- Comments & Colors- HTML CSS– Links & Images –Lists-Classes-Layout. **Illustrative Problem:** Develop a web page which includes various text formatting commands, Unordered list, ordered list, Table, simple form, hyper link, insert an image to Web page, insert scrolling text using Marquee tag, divide a page into Frames, simple layout of Webpage.	8 4
II	**UI DESIGN** HTML5 - Style Guide and Coding Convention – Html Svg and Canvas – Html API"s - Audio & Video - Drag/Drop - Local Storage - Web Socket API– Debugging and Validating Html. **Cascading Style Sheet** (CSS3): The Need for CSS – Basic Syntax and Structure - How to add CSS :Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning Using CSS -Responsive Web Design. **Illustrative Problem:** Develop a Tribute page by Make webpage writing about that person adding his/her image. On the top of the webpage, add the image and name of the person and below that give layout for the rest of the details. You can use paragraphs, lists, links, images with CSS to give it a descent look. Add a suitable background color and font style on your webpage. Most of the parts you can make using HTML but to give it a better look using a bit of CSS. Take help from the link given below.	8 4
III	**OVERVIEW OF JAVASCRIPT** Introduction - Objects- Scope – Data Types and Variables - Array, Date and Math Related Objects - Operators, Expressions, and Conditions, loop Statements – Type Conversion – Java Script Forms – Form Validations - Java Script HTML Document Object Model. **Illustrative Problem:** Develop a random quote generator app that displays random famous quotes every time a button is pressed in this project. A quote from a prominent athlete, politician, or historical figure can be displayed.	**8** 4
IV	**JAVASCRIPT ERROR HANDLING AND JQUERY** JavaScript Errors – Debugging – JavaScript Functions. Introduction to jQuery –Syntax – Selectors –Events – Traversing – AJAX. **Illustrative Problem:** Implement the project using AJAX and Jscript to create normal drop down box from which selecting an item will display its detail and information.	**8** 4

	PHP	
V	Introduction –Using Arrays – String Manipulations – Object Oriented PHP: Object Oriented Concepts – Creating Classes, Attributes, Operations in PHP – Implementing Inheritance in PHP. Creating Web Database: Creating database and users – Setting up user for web – Creating database Tables Inserting, retrieving and updating data into database – Altering tables. Accessing MySQL from web with PHP **Illustrative Problem:** Implement a Login System with PHP and My SQL. Implement an interactive web application for online shopping with PHP.	7 5
	Total Instructional Hours	**60**

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 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, BrentWare, "Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP" AddisonWesley, Pearson 2009

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

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

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

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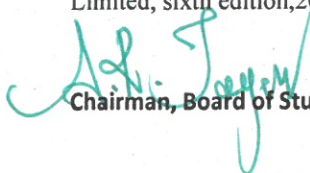| Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA1202	COMPUTER NETWORKS	3	0	0	3

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
I	**NETWORK FUNDAMENTALS** Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocols – OSI– LAN Topology - Transmission media.	9
II	**DATA LINK LAYER** Functions of Data link Layer - Flow Control Protocols – Error Detection – Parity check, Checksum & CRC - Error Correction - Hamming Code - Ethernet, Token ring, Wireless LAN.	9.
III	**NETWORK LAYER** Switching concepts – Circuit switching – Packet switching –IPV4, IPV6 —IP address Hierarchy – ICMP – Routing Protocols – Distance Vector – Link State.	9
IV	**TRANSPORT LAYER** Functions of Transport Layer -, Connection Establishment, Connection Release, Flow Control – Sliding Window protocol, UDP, TCP, Congestion control and Avoidance.	9
V	**REAL TIME APPLICATIONS& NETWORK SECURITY** DHCP – LDAP – HTTP – HTTPS – Packet Tracer – Cryptography – Ciphers – RSA algorithm – Web Security & Threats.	9
	Total Instructional Hours	45
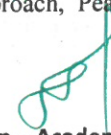
COURSE OUTCOME	CO1: Able to Understand the terminologies of Networks and Layers in a Network. CO2: Able to understand the working principles of Data Link Layer, its functions and Network technology applied in LAN. CO3: Able to understand the functionalities of Network Layer, IP addressing Mechanism and 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", Nineth Edition, Prentice Hall , 2011.

R3 – Behrouz A. Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw Hill, 2014

R4 - Andrew S. Tannenbaum David J. Wetherall, "Computer Networks" Fifth Edition , Pearson Education 2011

R5 - James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition,2012

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

Course Objective	1. 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
I	**INTRODUCTION** Introduction –JDK Installation and Path Specification - Java Application Structure - Data types – Variables – Arrays –Operators - Control Structures– Class – Objects – Methods – Overloading Methods - Constructors – "This" keyword - Garbage Collection	12
II	**OOPS** Nested classes – Inheritance – Using super keyword - Access specifier- Encapsulation-Interface-Polymorphism– Multi Level hierarchy – Method Overriding - Dynamic Method Dispatch – The Object class – Abstract classes -Package	12
III	**EXCEPTION HANDLING & THREADS** Exception handling – Using try catch – Nested try- throw – throws – finally – Built in exceptions – user defined exceptions - Threads – Thread model – Creating a thread – Thread priorities – Synchronization – Multithreading – String Handling – Tokenizer - Wrappers	12
IV	**AWT, FRAMES& APPLETS** AWT controls - Frames – Applet structure – HTML Applet Tag – Event Handling -Event Listeners - Applet Programming	12
V	**FILES & DATABASES** Networking – RMI- I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Java Collections	12
	Total Instructional Hours	60

Course Outcome	CO1: Create applications using classes and objects CO2: Design new applications by applying reusability and Packages concept CO3: Apply Multithreading concepts to execute parallelism Exception handling. CO4: Solve programs using Frames, Event handlers and Applets CO5: Compute 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
I	**INTRODUCTION, DATABASE DESIGN AND RELATIONAL MODEL** Introduction-Database System Applications, Purpose of Database Systems, View of Data – Database Languages, Database and Application Architecture, Database Users and Administrators – Database Schema – Keys – Schema Diagrams - ER diagrams – Mapping Cardinalities – Alternatives Notations for Modeling Data – Data Flow Diagram.	9
II	**RELATIONAL ALGEBRA, INTRODUCTION TO SQL & INTERMEDIATE SQL** Relational Algebra - Selection and Projection, Set operations, Renaming , Introduction to SQL – DDL – DML Commands – Basic Structure of SQL Queries – Set Operations – Null Values – Aggregate Functions – **Nested Sub Queries** – Intermediate SQL – Joins, Views and Transactions.	9
III	**ADVANCED SQL – FUNCTIONAL DEPENDENCY & NORMAL FORMS** Advanced SQL – Exceptional Handling using PL/SQL – Triggers & Cursors – Functions and Procedures – Subquery – Independent sub query - Correlated Sub Query- Functional Dependency - Reasoning about FDS-Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).	9
IV	**TRANSACTION PROCESSING AND CONCURRENCY CONTROL** Introduction- Transaction Concepts- Concurrency Control- Locking Methods for Concurrency Control- Timestamp Methods for concurrency control- Optimistic Methods for concurrency control.	9
V	**SPECIALITY DATABASES & NO SQL DATABASE** Overview, Complex Data Types, ODBMS & ORDBMS, Structured Types and Inheritance in SQL, Table Inheritance, Object-Identity and Reference Types in SQL.Unstructured database – NOSQL an Overview	9
	Total Instructional hours	45

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	21CA1001R	JAVA PROGRAMMING LAB	0	0	3	1.5

COURSE OBJECTIVE	1. To apply the object concepts, array of objects, control structure and constructorinJavaprograms. 2.To build programs to learn inheritances, interface, packages, applets and graphics 3. To construct programs to use exceptions and handle various events. 4. To develop programs to apply i/o concepts, multithreading and access database from GUI. 5. To implement applets in real world applications.

Unit	Description	Instructional hours

1	**OBJECT, ARRAYS, CONTROL STRUCTURE AND CONSTRUCTOR**
	  a. Write a program to calculate employee payroll using arrays and structures. Create 2 classes to perform payroll calculation and for input and output display. Based on basic pay create array to calculate HRA, DA, MA, PF and net pay.
	  b. Write a program for complex number operation using constructors
		3

2	**INHERITANCE** Give an array of size N which contains the marks of a student in N subjects, the task is to calculate the CGPA of the student. Write a program for marksheet preparation using 3 classes to get, calculate and display mark statement using inheritance. Note: Consider all marks to be out of 100 for each subject.	3

3	**INTERFACE AND PACKAGE**
	  a. Create an interface for declaring variables and methods and create two classes for performing calculation and execution to find voter eligibility.
	  b. Create a package for flat water maintenance bill, import the package in a class file to get input and display the final detailed bill. Note: Calculate water bill based on water consumption as given below: Rate (Rs/m³), Charges (Rs) Usage (m³), for 0 - 20 m³ -> Rs.0.50/-, for 21 - 35 m³->Rs.0.90/-, for > 35 m³->Rs.1.30/-
		3

4	**OVERLOADING, OVER-RIDING AND MULTITHREADING**
	  a. Write a program to calculate the area of square, rectangle and triangle. Create a method area, perform method over riding and overloading using the method area.
	  b. Write a program to display 16 times tables up to 16 using multithreading
		3

5	**USER-DEFINED AND PRE-DEFINED EXCEPTION HANDLER**
	  a. A company consists of 1000 employees over 50 years. Each employee is assigned with unique id number up to 1000. Write a program to check the details of the employee using employee id. Generate user-defined exception handler if the employee id is not in the database.
	  b. Create build-in exceptions using try and catch block. Arise exception in try block and handle the build-in exception in catch block. Execute the exception code in separate class to check arithmetic exception, array index out of bound exception, negative array size exception and number format exception.
		6

6	**STRING CLASS AND STRING TOKENIZER**
	  a. Get strings as input. Use switch statements to select the string functions like insert, append, delete, concatenate, find and replace. Read input and perform the actions using string buffer functions.
	  b. Get multiple statements as string input. Use full stop as String tokenizer. Using while loop count the tokens and display the string in separate line by sorting the string.
		6

7	**FILES AND STREAMS** Assign a variable to receive the units of electricity consumed, the task is to calculate the electricity bill using Files and streams, provided 1 to 100 units – Rs.10/unit, 100 to 200 units – Rs.15/unit, 200 to 300 units – Rs.20/unit and above 300 units – Rs.25/unit.	3

8	**VECTOR AND WRAPPER CLASS** A cone shaped tank is used to store water with 9 feet height and 14 feet diameter. Calculate the volume using vector and wrapper class by providing input values during run time, round off the values if needed and use pi=3.14. Formula to calculate volume is $v=1/3*pi*r^2*h$		3
9	**NETWORKING OPERATION** Create a client port, server port; buffer size and datagram socket. Connect both ports in two different command prompts and interchange text message between both the ports		3
10	**AWT CONTROLS** Use applet viewer to get personal details using text box for receiving name, check box group for gender details, text box with scroll bar for address details, List for qualification details, Choice option for country details and button to submit details. Using ActionListener() add the details and print the details.		3

11	**APPLET & FRAMES**
	  a. Create a class mouse extendapplet implementing MouseListener, MouseMotionListener. Override both methods using action commands performed by mouse events and print the mouse events like mouse pressed, released, clicked, dragged, moved, entered and exited.
	  b. Create a class KeyEvent extend Applet implementing KeyListener. Override both method using action commands performed by key events and print keyboard events like pressed, released and typed.
	  c. Create class using frame concept implementing WindowListener() and MouseListener()
			6

12	**DATABASE** Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so.		3
	Total Instructional hours		**45**

COURSE OUTCOME	CO1: Create object for the class and to input the values during run time. CO2: Write programs in inheritance and achieve reusability. Moreover, to implement interface, package, applet and graphics CO3: Develop programs to understand built in exception and custom exception. CO4: Construct programs in I/O Stream classes and threads, as well to connect databases. CO5: Extend client with server programs using network operations.

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

COURSE OBJECTIVE	1. To give a better insight about ER and DFD. 2. To 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
	Total Instructional hours	**45**

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	2	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

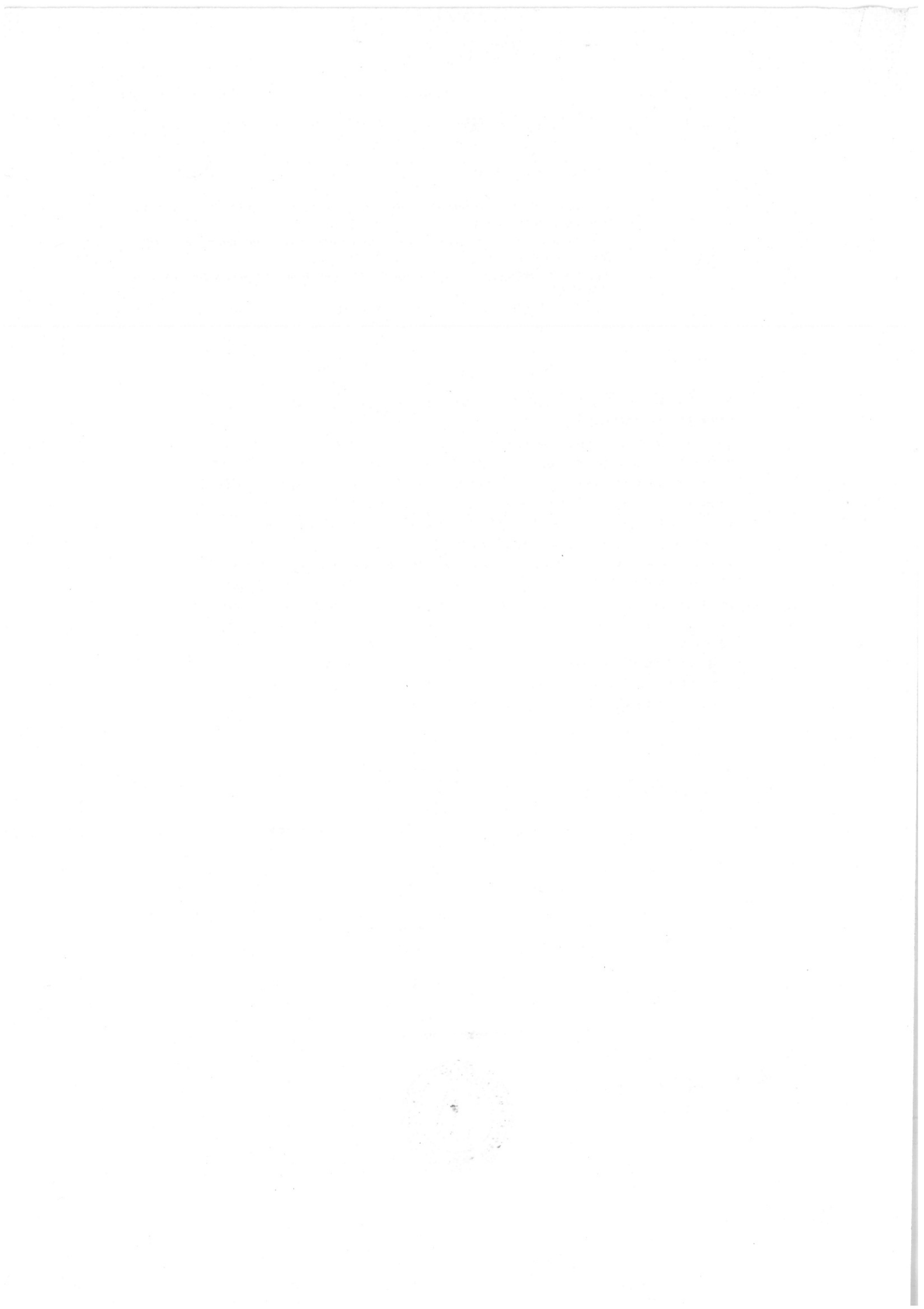| Unit	Description	Instructional Hours
I	**DESCRIBE BASIC COMMUNICATION PRINCIPLES & PLAN FOR EFFECTIVE COMMUNICATION** Identify professional communication skills- Identify effective verbal, nonverbal, and listening skills- Analyze the effect of the audience on a message - Analyze the effect of the environment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

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

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SEMESTER II - BRIDGE COURSE

EVEN SEM

Programme /Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2291	SOFTWARE ENGINEERING	3	0	0	-
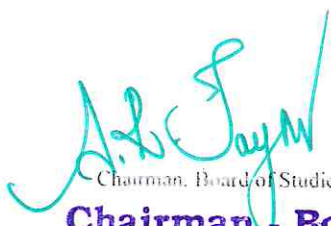
	The learner should be able to
COURSE OBJECTIVE	1. To provide an insight into the processes of software development 2. To understand and practice the various fields such as analysis, design, development, testing of software Engineering. 3. To develop skills to construct software of high quality with high 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
I	**INTRODUCTION** 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
II	**SOFTWARE DESIGN** 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
III	**SOFTWARE TESTING** 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
IV	**MAINTENANCE** Software Maintenance Organization –Maintenance Report – Types of Maintenance-Software maintenance activities-Software reverse engineering	9
V	**SOFTWARE METRICS** Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards	9
	Total Instructional hours	45

	At the end of the course, the learner will be able to
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.

23

REFERENCE BOOKS:

R1. Roger S. Pressman, "Software Engineering: A Practitioner Approach", Seventh edition, McGraw-Hill, 2010.

R2. Richard Fairley, "Software Engineering Concepts". Tata McGraw Hill Edition, 2008

R3. Ali 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. PankajJalote. "An Integrated approach to Software Engineering". Third Edition, Springer Verlag. 2005.

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

	The learner should be able to
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
I	**OS INTRODUCTION AND PROCESS MANAGEMENT AND SCHEDULING ALGORITHMS** **Introduction:** Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, System Calls, Operating System Structure **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Process Scheduling:** Basic concepts of scheduling, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. **Scheduling algorithms:** Pre-emptive and non-pre-emptive, FCFS, SJF, RR:	9
II	**PROCESS SYNCHRONIZATION,** **Inter-process Communication:** Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem **Concurrent Programming:** Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP): Deadlocks - prevention, avoidance, detection and recovery. .	9
III	**THREADS AND DEADLOCKS** **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery	9
IV	**MEMORY MANAGEMENT** **Memory Management:** Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	9
V	**FILE SYSTEMS MANAGEMENT, I/O AND DISK MANAGEMENT** **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping). **I/O Hardware:** I/O devices, Device controllers, Direct Memory Access, Principles of I/O. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	9
	Total Instructional hours	45

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

REFERENCES BOOKS:

R1. Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley, 10th Edition, 2019.

R2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.

R3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau. Operating Systems, Three Easy Pieces. Arpaci-Dusseau Books, Inc (2015).

R4. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education. 2006.

R5. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes. Operating systems. Delhi. Pearson Education: Dorling Kindersley, 2004.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2091	SOFTWARE ENGINEERING TOOLS LAB	0	0	3	-

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

S.No	Description Of The Experiments	
1	Develop requirements specification for a given problem.	
2	Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.	
3	Develop Structured design for the DFD model developed.	
4	Develop UML Use case model for a problem.	
5	Develop sequence diagram.	45
6	Develop Class diagrams	
For the Following Scenario • Passport automation System • Online Exam Registration • E-ticketing • Recruitment system		
	Total Instructional hours	45

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

SEMESTER II – REGULAR COURSES
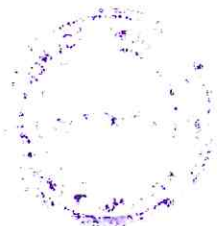
Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2201R	DATA STRUCTURES AND ALGORITHMS	3	1	0	4
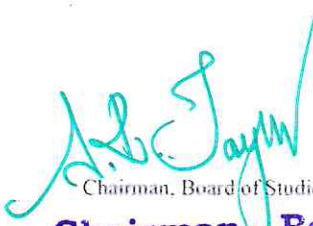
	The learner should be able to
COURSE OBJECTIVE	1. To Analyze the concept of Dynamic memory management. data types, algorithms, Big O notation. 2. To apply basic data structures such as arrays. linked lists, stacks and queues. 3. To experiment and solve problems involving graphs. trees and heaps. 4. To apply algorithms for solving problems like sorting. searching, insertion and deletion of data 5. To experiment the hash functions and concepts of collision and its resolution methods.

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

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

REFERENCE BOOKS :

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

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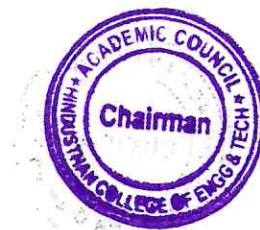
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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2203R	PYTHON PROGRAMMING	3	1	0	4

COURSE OBJECTIVE	**The learner should be able to** 1. To discover the basic concepts of Python Fundamentals. 2. To inference the data types, packages and module in python. 3. To implement file operation and exception handling. 4. To develop Object Oriented Programming Concepts. 5. To build web applications with database in python.

Unit	Description	Instructional Hours
I	**Basics of Python** Python – Features – Setting up the environment – IDE, Anaconda, Pycharm, Jupyter, Spyder– Keywords – Identifiers - Input & Output Statements – Data types – Conditional checking and branching – Conditional checking and looping – Else statement – Break & Continue – Function Call and Returning Values	12
II	**Data Typesin Python** Lists – Tuples – Set – Dictionaries – Strings – Regular Expressions Modules: Module Loading and Execution–Packages–Making Your Own Module–Python Standard Libraries	12
III	**File Handling and Exception Handling** Files: Introduction – File Path–Opening and Closing Files, Reading and Writing, Pickle and Unpickle, Exception handling – Assertions and Logging – Create User Defined Exceptions.	12
IV	**Object Oriented Programming** Classes and Objects – Constructors –Destructors –Getter and Setter Methods –Encapsulation – Inheritance – Polymorphism – Abstract classes and Interfaces	12
V	**Web Operations in Python** Basic Web Application Structure –Templates – Web Forms – Databases – Web Scrapping in Python	12
	Total Instructional Hours	60

COURSE OUTCOME	At the end of the course, the learner will be able to CO1: Able to discover the basic concepts of Python Fundamentals. CO2: Able to inference data types, packages and module in python. CO3: Able to implement file operation and exception handling. CO4: Able to develop Object Oriented Programming Concepts. CO5: Able to build web applications with data base.

REFERENCE BOOKS:

R1- Kent D. Lee, " Python Programming Fundamentals", Springer, 2014

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, Packt Publishing, 2015

R4 - Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes

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

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

Unit	Description	Instructional hours

I	**JAVASCRIPT AND BASICS OF MERN STACK**
	Javascript Fundamentals - Objects - Generators. Advanced Iteration - Modules - CSS, SCSS and Bootstrap - Dom Tree - Node Properties - Browser Events - Event Delegation - UI Events -Forms, Controls - Document and Resource Loading - Mutation Observer - Event Loop: Microtasks and Macrotasks - Mern Components - React - Node.Js - Express - Mongodb - Need for Mern - Server-Less Hello World - Server Setup - NVM - Node.Js - Npm.
	Program
	  i. *Simple programs in MERN environment*
	  ii. *Programming exercise on JavaScript basic and advanced features*
		12

II	**EXPRESS JS** Express - Restful Services - Introducing Express - Building Your First Web Server - Nodemon - Environment Variables - Route Parameters - Handling Http Get Request - Handling Http Post Request - Calling Endpoints Using Postman - Input Validations - Handling Http Put Request - Handling Http Delete Request	12

III	**REACTJS**
	Introduction To React – Installation –Introduction To Jsx – Rendering Jsx Elements – Jsx Expressions – Jsx Attributes – Jsx Comments – Jsx Styling – Creating Components – Managing State – Using Props – Nested Components – Life Cycle Methods- Functional Components-Creating React Application –- Constructors - Forms – Events – List – Keys – Refs – Fragments – Router – Css – Using Javascript Objects - Animations – Css Transition – React Hooks –- Bootstrap – Installation - Map – Table– Higher Order Components – Flux - Redux Fundamentals – Redux Store – Redux Reducers – Redux Components
	Program
	  iii. *REACT based programming*
	  iv. *Exploring stateless components*
	  v. *Designing components with React CSS and SaaS*
		12

IV	**NODEJS** Introduction – Installation – Console – Repl Commands – Package Manager – Command Line Options – Functions - Global Objects – Timer – Error Handling – Dns – Callbacks – Events – Web Module – Node.js Mysql - RESTful API. *Program* vi. *Node and Express based web development Handling of various APIs associated with Node.js*	12
V	**NODEJS WITH MYSQL AND MONGODB** Create Connection with Mysql - Mysql Create Database - Js Mysql Create Table - Insert Records - Update Records - Delete Records - Select Records - Drop Table. Create	12

	Connection with Mongodb – Installation – Introduction to Mongodb (No-Sql) - Collections in Mongodb - Documents in Mongodb - Difference Between Mysql and Nosql Create Database - Insert Record - Select Record - Filter Query – Sorting – Remove Program	
	vii. Data manipulation exercises (CRUD)	
	viii. Querying the MongoDB databases	
	ix. Exploring Arregation, Replication, Sharding and other features in MongoDB	
	Total Instructional hours	60
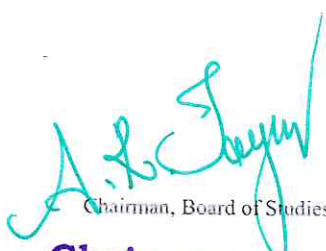
COURSE OUTCOME	CO1: Construct client-side scripting using JS and MERN stack. CO2: Design applications using Express Framework. CO3: Build React web applications. CO4: Implement Web Application using NodeJS. CO5: Construct database connectivity in Node.js.

Reference

R1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node. Vasan Subramanian, A Press Publisher, 2019.

R2 :Jobinesh Purushothaman, "Restful Java Web Services". Second Edition, Packt Publishing, 2015.

R3: Robin Wieruch – "The road to react, your journey to master plain yet pragmatic React ", 2016.

R4 : Cory Gackenheimer, " Introduction to React" – Published by Apress- 2015.

R5. Alex Banks, Eve Porcello, "Learning React". O'Reilly Media, Inc, 2nd Edition, 2020

R6. Marc Wandschneider, "Learning Node". Addison-Wesley Professional, 2nd Edition, 2016

R7. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019

Web Reference

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

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

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

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

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

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

REFERENCEBOOKS:

1.   David A .Patterson, John L. Hennessy. "Computer Organization and Design, The Hardware/ Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier. 2013.
2.   M. Morris Mano, Michael D.Ciletti. "Digital Design". Fifth Edition, Pearson Education. 2013.
3.   Carl Hamacher, Zvonko Vranesic. SafwatZaky. 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/ Sem	Course Code	Name of the Course	L	T	P	C
MCA/ II	21CA2001	PYTHON PROGRAMMING LAB	0	0	3	1.5

COURSE OBJECTIVE	1. To develop Python programs using control and looping Structures. 2. To develop Python programs using various data structures. Strings. Functions. Regular Expressions and Packages. 3. To develop programs using File Handling and Exception Handling. 4. To develop programs using Object Oriented Programming Concepts. 5. To implement the programs using web operations in python.

S.no	Description of the experiments	practical hours
1.	**Module 1:** **Programs on basics of python** 1. Install anaconda. pycharm and Jupiter. 2. Use format() method to display the user given input. 3. Implement password validation using conditional checking and branching. 4. Predict the future tuition fees for a university using conditional checking and looping. 5. Implement python calculator using conditional checking with break and continue statement. 6. Implement movie ticket booking management system in python using functions and returning values.	9

2	**Module 2:**
	
	Programs on data types in python
	1. Create a list with 10 elements
	   a. Slice first element. b. Slice last element.c. Slice 3rd to 7th element.
	   d. Index the list. e. Add one element to list. f. Add several elements to list.
	2. Create two list
	   a. Combine two list b. Repeat the list for given number of times.
	   c. Remove an element from the list. d. Empty the list.
	3.Create a tuple named as TUPLE1 with the following items in the Tuple.
	   i. TUPLE1 = ('tupleexample'. False. 3.2. 1)
	   ii. TUPLE2 = tuplex = ("p", "y", "t", "h", "o", "n", "c", "o","d","e")
	
	   a. Display the TUPLE 1, TUPLE2 b. Display the 4th Item from the TUPLE2 c. Display the 4th Item from TUPLE2 using Negative Indexing.d.Check whether the element 3.2 exist in TUPLE1.
	   e. Convert the List1 = [1.2.3.4.5.6] to a TUPLE.
	   f. Unpack the TUPLE3 = 4,8,3 into Several variables.
	   g. Count the frequency of the Item "o" from TUPLE2.
	   h. Display the length of the TUPLE2.
	   i. Reverse the TUPLE2.
	3. Create a dictionary
	   a. Get a list of all keys. b. Get a list of all values.c. Slice a dictionary.
	   d. Remove an element from dictionary. e. Clear the dictionary.
	4. Do membership test and iterate over the list.
	5. Get string input from user. In that string
	   a. Check for a phrase or a character
	   b. Check for duplicated words. If there is a duplicate word counts on it.
	   c. Do string strip and string replace operation?
		9

		6. Create a module, import it and execute in python.	

3		**Module 3:**
		
		 Programs on File handling and Exception handling
		 1. Implement file concept in python. In a File do the following file operations:
		    a. Open a file and read its content.
		    b. Open a file and write its content to another file.
		    c. Open a file and append its content.
		 2. Implement Pickle and unpickle in python.
		 3. Implement Exception handling in python.
		 4. Do python code for assertions and logging.
		 5. Implement custom exceptions.
			9

4		**Module 4:** **Programs on Object Oriented Programming.** 1. Implement constructor and destructors in python. 2. Use getter and setter method in your program to get and set values from user. 3. Implement inheritance in python. 4. Implement polymorphism in python. Implement abstract class and interface in python.	9
5		**Module 5:** **Programs on web operations in python.** 1. Develop a web application using web forms. 2. Implement the python program to perform various database operations. 3. Implement web scramping.	9
		Total Instructional hours	45

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

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

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

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

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

	Exercise programs on Hashing and Algorithm Analysis		
4.	a. Given a set of cities and the distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. Implement and solve the Travelling salesperson problem using branch and bound. b. Demonstrate a program to insert a value into the hash table and search a value using linear probing. c. Demonstrate a program to insert a value into the hash table and search a value using quadratic probing. d. Demonstrate a program to insert a value into the hash table and search a value using double hashing. e. The problem of placing eight queens on an 8×8 chessboard such that none of them attack one another (no two are in the same row, column, or diagonal). Solve 8 queen's problem using backtracking method.		9
		Total Instructional hours	45

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 apply 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

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

COURSE OUTCOME	CO1: 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, 2nd edition. Auerbach. 2008
2. HarlonCarvey. 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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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2302	GREEN COMPUTING	3	0	0	3
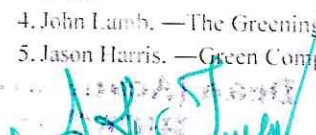
COURSE OBJECTIVE	1. To learn the fundamentals of Green Computing. 2. To analyze the green computing Grid Framework. 3. To understand the issues related with green compliance. 4. To understand about the future technology of Green Computing. 5. To study and develop various case studies.

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

COURSE OUTCOME	CO1: 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. Aagust 2012.
3. Alin Gales, Michael Schaefer, MikeEbbers. ―Green Data Center: steps for the Journey. Shroft 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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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA II	21CA2303	HUMAN COMPUTER INTERACTION	3	0	0	3
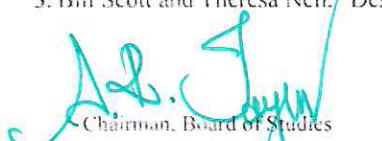
COURSE OBJECTIVE	1. To learn the basic foundations of Human Computer Interaction. 2. Be familiar with the design technologies and Software Process Involved in HCI. 3. To getter a better understanding about Models and Theories of HCI. 4. To have an understanding on Mobile HCI 5. To gain knowledge on Web Interface Design and its Frameworks.

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

COURSE OUTCOME	CO1: Acquire fundamental concepts of computer components functions regarding interaction with human CO2: Analyze interface problems to recognize what design approach and interaction styles is required in the light of usability standards and guidelines. CO3: Analyze the various Models and Theories with respect to HCI. CO3: Acquire an understanding on Mobile HCI. CO4: Develop meaningful user interface with recent technologies.

REFERENCE BOOKS:

1. Alan Dix. Janet Finlay, Gregory Abowd. Russell Beale. "Human Computer Interaction". 3rd Edition. Pearson Education. 2004 (UNIT I , II & III).

2. Brian Fling. "Mobile Design and Development". First Edition. O'Reilly Media Inc.. 2009 (UNIT –IV).

3. Bill Scott and Theresa Neil. "Designing Web Interfaces". First Edition. O'Reilly. 2009. (UNIT-V).

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

COURSE OBJECTIVE	1. To correlate computer ethics in work environment. 2. To discover the threats in computing environment 3. To discover the intricacies of accessibility issues 4. To use safe exits when designing the software projects 5. To distill the concepts of computer ethics in work environment

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

COURSE OUTCOME	CO1: Able to correlate computer ethics in work environment. CO2: Able to discover the threats in computing environment. CO3: Able to discover the intricacies of accessibility issues . CO4: Able to use safe exits when designing the software projects . CO5: Able to distill the concepts of computer ethics in work environment.

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

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	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

Unit	Description	Instructional Hours
I	**INTRODUCTION** HTML coding - Basic web graphics - Web page design and site building - Image maps - Adding multimedia to the web- Vector and Raster graphics.	9
II	**RASTER IMAGE EDITING SOFTWARE** Introduction - Image Basics - File Formats - GIF - JPEG - Color Palette – Color models Layers - Creating new Images - Brushes – Grids and Guides- Gradients - Scaling Images - Moving and Merging Layers - Tool Palette - Dialogs - Masking – Filters – Adding text to images – Designing icons and background images.	9
III	**VECTOR IMAGE HANDLING** Introduction – Creating Simple Vector graphics – Creating banners -Images - Working with layers – Tweening - Motion guide – Masking – Frame by Frame animation – Onion Skin Effect – Creating special effects - Text effects and animation – Action scripts.	9
IV	**MULTIMEDIA** Creating clippings - Animations with sound effects - Adding audio or Video - Windows Media Player ActiveX Control - Agent control - Embedding VRML in a web page - Real Player ActiveX control.	9
V	**APPLICATIONS** Creating web site with a particular theme using all the utilities - Graphics - Animations and Interaction.	9
	Total Instructional Hours	45
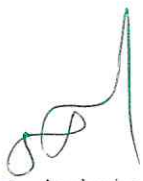
COURSE OUTCOME	CO1: Understand the Concepts of HTML and simple web site creation using HTML CO2: Designing web pages using image editing software and its tools CO3: Creating Flash web site CO4: Correctly explain a variety of terms relating to web design. HTML. CSS. and Flash. CO5: Design. create. and upload an original website.

REFERENCE BOOKS :

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

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Programme/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2306	DIGITAL LOGIC AND COMPUTER ORGANIZATION	3	0	0	3
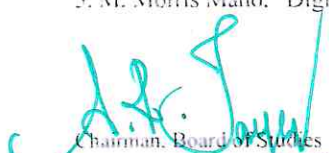
COURSE OBJECTIVE	1. To discover the fundamentals of Boolean logic and functions.
	2. To design and realize digital systems with basic gates and other components using combinational and sequential circuits.
	3. To interpret the instruction sets and operations of a processor.
	4. To analyze the different ways of communication with I/O devices and standard I/O Interfaces.
	5. To inspect the hierarchical memory system including cache memories and virtualmemory.

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

COURSE OUTCOME	CO1:Able to discover the fundamentals of Boolean logic and functions.
	CO2:Able to design and realize digital systems with basic gates and other components using combinational and sequential circuits.
	CO3:Able to interpret the instruction sets and operations of a processor.
	CO4:Able to analyze the different ways of communication with I/O devices and standard I/O Interfaces.
	CO5:Able to inspect the hierarchical memory system including cache memories and virtual memory

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. SafwatZaky. 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/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2307	E-LEARNING TECHNIQUES	3	0	0	3
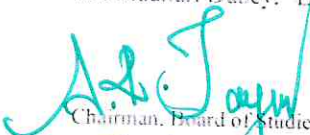
COURSE OBJECTIVE	1. To Analyze phases of activities in the models of E-learning.
	2. To identify appropriate instructional methods and delivery strategies
	3. To understand and choose appropriate E-learning authoring tools.
	4. To Adapt interactive E-Learning Platforms.
	5. To choose the E-learning course delivery and evaluation methods.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous andAsynchronousModesofLearning–QualityofE-Learning–BlendedLearning: Activities, Team and Technology–Work Flow to Produce and Deliver E-Learning Content–Basics of Design Thinking.	9
II	**DESIGNING E-LEARNING COURSE CONTENT** Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content –Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods –Defining Evaluation And Delivery Strategies – Case Study	9
III	**CREATINGINTERACTIVECONTENT** Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests –AddingAdditionalResources–CoursewareDevelopment–AuthoringTools–TypesofAuthoringTools–SelectinganAuthoringTool.	9
IV	**LEARNINGPLATFORMS** Types of Learning Platforms – Proprietary Vs. Open –Source LMS – LMS Vs LCMS –Internally Handled and Hosted LMS –LMS Solutions – Functional Areas of LMS.	9
V	**COURSEDELIVERYANDEVALUATION** Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats –Using Communication Tools for E-Learning – Course Evaluation.	9
	Total Instructional Hours	45

COURSE OUTCOME	CO1: 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/Sem	Course Code	Name of the Course	L	T	P	C
MCA/II	21CA2308	BLOCK CHAIN TECHNOLOGIES	3	0	0	3

COURSE OBJECTIVE	1. To understand the technology components of Block chain. 2. To gain insights on Bit coins and Crypto currency and its limitations with Other 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 understand the alternative block chains and emerging trends in block chain

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

COURSE OUTCOME	CO1: Ability to Understand the technology components of Blockchain and its working principles behind the scenes. CO2: Understand the Bitcoin and its limitations by comparing with other alternative coins. CO3: Ability to gain deep understanding of the Ethereum model, its consensus model and code execution. CO4: To gain better insights on the architectural components of Hyper ledger and its 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 Madisetti, "Blockchain Applications: A Hands-on Approach", VPT Publisher, 2017.
R3. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
R4. Roger Wattenhofer, "The Science of the Blockchain," Create Space 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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Programme	Course Code	Name of the Course	L	T	P	C
MCA	21CA2309	Introduction to Machine Learning	3	0	0	3

Course Objective	1. Gain a Historical perspective of Machine Learning and become familiar with End to End Process of ML and ML Packages
	2. Gain knowledge to experiment with Regression Algorithms.
	3. Gain knowledge to experiment with Classification Algorithms.
	4. To have a deeper insight on Unsupervised Learning Algorithms
	5. Exploring more on Tuning parameters in ML

Unit	Description	Instructional Hours
I	**Introduction** Machine Learning: Introduction – History – Applications – Life Cycle – AI vs ML. Dataset: Types – Need – sources of ML datasets – Types of Machine Learning, Supervised, Unsupervised and Reinforcement Learning - End to End process of ML with a Case Study	9
II	**Regression** Regression Analysis – Terminologies – Types: Simple Linear Regression, Multiple Linear Regression - Polynomial Regression – Gradient Boost , XGBoost - Decision Tree Regression – Random Forest Regression - Jupyter notebook + Anaconda/Google Colab, Numpy, Pandas, Sci-kit Learn, Matplotlib and Seaborn	9
III	**Classification** Classification Types – Binary and Multiclass Classification - Logistic Regression - Support Vector Machines - Decision Tree Classification - Random Forest Classification - visualizing the decision boundaries – XG Boost Classification	9
IV	**Unsupervised Learning** Need for unsupervised Learning - K-means clustering- k-medoids - Hierarchal clustering – Anomaly Detection.	9
V	**ML Principles** Overfitting – Under fitting – data leaking - Principal Component Analysis – Cross Validation – P-value – hypothesis	9
Total Instructional Hours		**45**

Course Outcome	1. To have insight into types of ML algorithms and build applications by applying various Data analysis tools and ML Packages.
	2. To develop applications using various Regression Algorithms.
	3. To develop Applications using Various Classification Algorithms.
	4. To Identify and develop applications using Unsupervised learning Algorithms
	5. To develop insights on tuning and hyper parameters in ML.

REFERENCE BOOKS:
1. Frank Pane, "Hands On Data Science and Python Machine Learning", Packt Publishers, 2017.
2. Bharti Motwani, "Data Analytics using Python", Wiley Publishing 2020
3. EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series) I, Third Edition, MIT Press, 2014
4. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019

5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Revised Edition, Springer, 2016.

6. AurelienGeron, "Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow", 2nd Edition, O"Reilly, 2019

7. Stephen Marsland, —Machine Learning – An Algorithmic Perspectivel, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

8. Tom M. Mitchell, "Machine Learning", India Edition, 1st Edition, McGraw-Hill Education Private Limited, 2013

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Course Code & Name 21CA3203R **Web Development**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	0.4	2.6	2.6	2	2.6	0.4	2	2.6	0.4	2	2.6	2.6	2.6	1.4

Course Code & Name 21CA3205 **Cryptography and Network Security**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	1	2	2	1	2	1	1	2	1	1	2	2	2	0
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	2.6	0.4	0.4	1	0.4	2.6	1	0.4	2.6	1	0.4	0.4	0.4	1.6

Course Code & Name 21CA3251 **Data Science and Analytics**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	2	2	2	1		3		1	0	0	0	3	1
CO2	3	3	3	3	3	3	3	3	1	0	0	0	3	1
CO3	3	3	3	3	3	3	3	3	1	0	0	0	3	3
CO4	3	3	3	3	3		3		1	0	0	0	3	2
CO5	3	3	3	3	3	3	3		1	0	0	0	3	1
Average	3	2.8	2.8	2.8	2.6	3	3	3	1	0	0	0	3	1.6

Course Code & Name 21EC3251 **Internet of Things**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	1	-	-	-	-	-	-	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
Aver age	3	1.6	2.8	1.8	2.2	2.0	1.3	1.3	0	0	1	1.2	2.6	3

Course Code & Name **21CA3302** **Cloud Computing**

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	1			0	0	0	0	0	0	2	3
CO2	2	1	2	3	2	1								1
CO3	2	1	2	3	2	1								1
CO4	2	3	2	1									2	3
CO5	2	1	2	3	2	1								1
Aver age	2	1.8	2	2.2	2	1	0	0	0	0	0	0	2	1.8

Course Code & Name **21CA3002R** **Web Development Lab**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Aver age	0	3	3	2	3	0	2	3	0	2	3	3	3	1

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

Academic Year 2022 - 2023 - Semester – I - Btach 2022 - 2024

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

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P 10	P 11	P 12	PSO1	PSO 2
CO1	2	3	2	1	1		0	0	0	0		1	2	2
CO2	2	3	2	1	1			-	-	-		1	2	2
CO3	2	2	2	2	2			-	-	-		1	2	2
CO4	3	3	3	1	2	2		-	-	-	1	2	2	2

CO5	3	3	3	2	2	1		-	-	-	1	2	2	3
Average	2.4	2.8	2.4	1.4	1.6	2	0	0	0	0	1	1.4	2	2.2

Course Code & Name   **21CA1251**   **UI Design & Development**

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

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

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

Course Code & Name   **21CA1203R**   **Java Programming**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	0.4	2.6	2.6	2	2.6	0.4	2	2.6	0.4	2	2.6	2.6	2.6	1.4

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

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

Course Code & Name — **21CA1001R** — **Java Programming Lab**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	2	0	0	0	1	0	3	3
CO2	3	3	3	3	2	2	2	0	0	0	0	1	3	3
CO3	3	3	3	3	1	2	2	0	3	0	1	0	3	3
CO4	3	3	3	3	1	2	2	0	2	0	0	0	3	3
CO5	3	3	3	3	1	2	2	0	3	0	0	0	3	3
Average	3	3	3	3	1.4	2	2	0	1.6	0	0.4	0.2	3	3

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	2	3	0	0	0	1	1	3	1
CO2	3	3	3	2	3	2	2	1	0	0	0	0	3	1
CO3	3	3	3	3	2	1	3	0	0	0	1	0	3	1
CO4	3	3	2	3	3	1	2	0	0	0	0	1	3	2
CO5	3	3	3	3	2	1	3	1	0	0	0	0	3	1
Average	3	3	2.8	2.6	2.6	1.4	2.6	0.4	0	0	0.4	0.4	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 2022 - 2023 - Semester – II - Btach 2022- 2024

Course Code & Name			21CA2201R	Data Structures and Algorithms										

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO2	3			1		3	1		3	1				2
CO3	3			1		3	1		3	1				2
CO4	1					1			1					
CO5	3			1		3	1		3	1				2
Average	2.2	2	2	1.5	2	2.2	1.5	2	2.2	1.5	2	2	2	2

Course Code & Name			21CA2251	Web Development										

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	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	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	0.6	2.4	2.4	1.8	2.4	0.6	1.8	2.4	0.6	1.8	2.4	2.4	2.4	1.2

Course Code & Name			21CA2203R	Python Programming										

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	1	2	2	1	2	1	1	2	1	1	2	2	2	0
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	2.6	0.4	0.4	1	0.4	2.6	1	0.4	2.6	1	0.4	0.4	0.4	1.6

Course Code & Name			21EC2251	Electronics for Embedded System										
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	0	0	1	3	3	1	0	3	1	0	0	0	1
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	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO5	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Average	1.2	1.8	1.8	1.6	2.4	1.2	1.6	1.8	1.2	1.6	1.8	1.8	1.8	1.2

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	3	3	3	2	3	2	3	0	0	0	0	0	3	1
CO2	3	3	3	3	3	1	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	0.6	2.8	0	0	0	0	0	3	1.2

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

Academic Year 2020 - 2021 - Semester – II - Btach 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

Aver age	2	0	0	0	0	2	0	0	2	0	0	0	0	1

Course Code & Name			21C A23 02	Green Computing										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	2	0.2	0.2	0.4	0	2	0.4	0	2	0.4	0	0	0	1.4

Course Code & Name			21C A23 03	Human Computer Interaction										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	1.2	1.4	1.4	1.2	0.8	1.2	1.2	0.8	1.2	1.2	0.8	0.8	0.8	1.4

Course Code & Name			21C A23 04	Professional Ethics										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	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			21C A23 05	Web Graphics										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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

Aver age	3	3	2.4	3	1.8	3	3	2.4	3	3	2.4	2.4	2.4	3
Course Code & Name			**21C A23 06**	**Digital Logic and Computer Organization**										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	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			**21C A23 07**	**E-Learning Techniques**										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	1	1.6	1.6	1.4	1.2	1	1.4	1.2	1	1.4	1.2	1.2	1.2	1.2
Course Code & Name			**21C A23 08**	**Block Chain technologies**										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
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
Aver age	1.2	1.4	1.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.4
Course Code & Name			**21C A23 09**	**Introduction to Machine Learning**										
PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	3	3	1	3	0	0	0	1	0	0	0	2	2
CO2	3	3	3	2	3	0	0	0	1	0	0	0	3	3
CO3	3	3	3	2	3	0	0	0	1	0	0	0	3	3
CO4	3	3	3	2	3	0	0	0	1	0	0	0	3	3
CO5	3	3	3	2	3	0	0	0	1	0	0	0	3	3
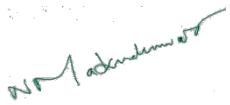
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Average	3	3	3	1.8	3	0	0	0	1	0	0	0	2.8	2.8		
II	III	21CA3203R - Web Development	0.4	2.6	2.6	2	2.6	0.4	2	2.6	0.4	2	2.6	2.6	2.6	1.4
		21CA3205 - Cryptography and Network Security	2.6	0.4	0.4	1	0.4	2.6	1	0.4	2.6	1	0.4	0.4	0.4	1.6
		21CA3251- Data Science and Analytics	3	2.8	2.8	2.8	2.6	3	3	3	1	0	0	0	3	1.6
		21EC3251 - Internet of Things	3	1	3	3	3	2	2	2	-	-	1	2	3	3
		21CA3302- Cloud Computing	2	1.8	2	2.2	2	1	0	0	0	0	0	0	2	1.8
		21CA3002R - Web development Lab	0	3	3	2	3	0	2	3	0	2	3	3	3	1
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	I	21MA1101- Probability, Statistics and Operation Research	2.4	2.8	2.4	1.4	1.6	2	0	0	0	0	1	1.4	2	2.2
		21CA1251- UI Design and Development	2.2	2	2.4	1	2.2	0	2.2	0	0.4	0	1	0	2.2	1.2
		21CA1202 Computer Networks	2	1.8	2	2.2	2	1	0	0	0	0	0	0	2	1.8
		21CA1203R - Java Programing	0.4	2.6	2.6	2	2.6	0.4	2	2.6	0.4	2	2.6	2.6	2.6	1.4
		21CA1204 - Database management system	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
		21CA1001R - Java Programing Lab	3	3	3	3	1.4	2	2	0	1.6	0	0.4	0.2	3	3

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		21CA1002 - Database management system Lab	3.0	3.0	2.8	2.6	2.6	1.4	2.6	0.4	0.0	0.0	0.4	0.4	3.0	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
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
II	II	21CA2201R Dtata Structures and algorithms	2.2	2	2	1.5	2	2.2	1.5	2	2.2	1.5	2	2	2	2
		21CA2251- Web Development	0.6	2.4	2.4	1.8	2.4	0.6	1.8	2.4	0.6	1.8	2.4	2.4	2.4	1.2
		21CA2203R - Python Programming	2.6	0.4	0.4	1	0.4	2.6	1	0.4	2.6	1	0.4	0.4	0.4	1.6
		21EC2251 Electronics for embedded system	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	1.2	1.8	1.8	1.6	2.4	1.2	1.6	1.8	1.2	1.6	1.8	1.8	1.8	1.2
		21CA2002 - Data Structures and Algorithms Lab	3	3	3	2.8	3	0.6	2.8	0	0	0	0	0	3	1.2
Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	Electives Sem II	21CA2301 - Cyber Security	2	0	0	0	0	2	0	0	2	0	0	0	0	1
		21CA2302 - Green Computing	2	0.2	0.2	0.4	0	2	0.4	0	2	0.4	0	0	0	1.4
		21CA2303 - Human Computer Interaction	1.2	1.4	1.4	1.2	0.8	1.2	1.2	0.8	1.2	1.2	0.8	0.8	0.8	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

Course															
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	1.6	1.6	1.4	1.2	1	1.4	1.2	1	1.4	1.2	1.2	1.2	1.2
21CA2308 - Block Chain Technologies	1.2	1.4	1.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.4
21CA2309- Introduction to Machine learning	3	3	3	1.8	3	0	0	0	1	0	0	0	2.8	2.8

BoS Chairman   **Dean Academics**