R – 2020
MASTER OF COMPUTER APPLICATIONS
CURRICULUM
SEMESTER I

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
			BRIDGE COURSE – ODD SEM							
1			PROGRAMMING IN C	10	0	0	--	0	0	10
2			PROBLEM SOLVING AND PROGRAMMING	10	0	0	--	0	0	10
3			PROGRAMMING IN C	0	0	10	--	0	0	10
			TOTAL				0			

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	20MA1101	FC	PROBABILITY AND STATISTICS, OPERATIONS RESEARCH	3	1	0	4	40	60	100
2	20CA1201	PC	UI DESIGN & DEVELOPMENT	3	1	0	4	40	60	100
3	20CA1202	PC	COMPUTER NETWORKS	3	0	0	3	40	60	100
4	20CA1251	IC	JAVA PROGRAMMING	3	1	0	4	40	60	100
5	20CA1252	IC	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	40	60	100
6	20CA1001	EEC	JAVA PROGRAMMING LAB	0	0	3	1.5	50	50	100
7	20CA1002	EEC	DBMS LAB	0	0	3	1.5	50	50	100
8	20AC1171	AC	COMMUNICATIVE SKILL FOR BUSINESS ENGLISH	2	0	0	2	100	---	100
			TOTAL				23			

SEMESTER II

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
			BRIDGE COURSE – EVEN SEMESTER							
1			OBJECT ORIENTED PROGRAMMING	10	0	0	--	0	0	10
2			COMPUTER ORGANIZATION AND ARCHITECTURE	10	0	0	--	0	0	10
3			OBJECT ORIENTED PROGRAMMING LAB	0	0	10	--	0	0	10
			TOTAL				0			

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	20MA2101	FC	SOFTWARE ENGINEERING	3	1	0	4	40	60	100
2	20CA2201	PC	DATA STRUCTURES AND ALGORITHMS	3	1	0	4	40	60	100
3	20CA2151	IC	PYTHON PROGRAMMING	3	0	0	3	40	60	100
4	20CA2152	IC	DATA ANALYTICS USING R PROGRAMMING	3	1	0	4	40	60	100

5	20CA23XX	PE	**PROFESSIONAL ELECTIVE – 1 / NPTEL / EDX**	3	0	0	3	40	60	100
6	20AC2171	AC	L/S/MOOC	2	0	0	2	100	---	100
7	20CA2001	EEC	**PYTHON PROGRAMMING LAB**	0	0	3	1.5	50	50	100
8	20CA2002	EEC	**DATA STRUCTURES & ALGORITHMS LAB**	0	0	3	1.5	50	50	100
9	20CA2801	EEC	**INTERNSHIP / INDUSTRIAL TRAINING**	0	0	0	2			
			TOTAL				25			

SEMESTER III

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	20CA3201	PC	**DATAMINING AND DATA WAREHOUSING**	3	0	0	3	40	60	100
2	20CA3202	PC	**OPERATING SYSTEMS**	3	1	0	4	40	60	100
3	20CA3151	IC	**WEB DEVELOPMENT**	3	1	0	4	40	60	100
4	20CA3152	IC	**ARTIFICIAL INTELLIGENCE**	3	1	0	4	40	60	100
5	20CA33XX	PE	**PROFESSIONAL ELECTIVE – II**	3	0	0	3	40	60	100
6	20CA3171	AC	L/S/MOOC	2	0	0	2	100	---	100
7	20CA3001	EEC	**MINI PROJECT LAB**	0	0	3	1.5	50	50	100
8	20CA3002	EEC	**AI LAB**	0	0	3	1.5	50	50	100
			TOTAL				23			

SEMESTER IV

S.No.	Course Code	Course Category	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	20CA4901	EEC	**PROJECT WORK**	0	0	0	14	50	50	100
			TOTAL	0	0	0	14			

Total No of Credits: 85

CURRICULUM –PROFESSIONAL ELECTIVE LIST

S.No.	Course Code	Semester	Course Title
1	20CA2301	II	Cyber Security
2	20CA2302	II	Green Computing
3	20CA2303	II	Human Computer Interaction
4	20CA2304	II	Professional Ethics
5	20CA2305	II	Web Graphics
6	20CA2306	II	Digital Logic and Computer Organization
7	20CA2307	II	Principles of Programming Languages
8	20CA2308	II	Accounting and Financial Management

S.No.	Course Code	Semester	Course Title
9	20CA3301	III	Data Science
10	20CA3302	III	Cryptography and Network Security
11	20CA3303	III	Semantic Web Services
12	20CA3304	III	Cloud Computing
13	20CA3305	III	E- Commerce
14	20CA3306	III	Organizational Behavior
15	20CA3307	III	Deep Learning

DISTRIBUTION OF CREDITS

Course Category	FC	PC	IC	PE	AC	EEC	TOTAL
Credit	8	18	22	6	6	25	85
%	9.4	21.1	25.8	7.1	7.1	29.4	100

Total No of Credits: 85

BRIDGE COURSE – ODD SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
MCA		**PROGRAMMING IN C**	10	0	0	0

Unit	Description	Instructional hours
I	Introduction in C- Process of programming – GCD- Programming Cycle – Tracing a Simple Program – Variables	1
II	Operators – Loops – Matrix used Nested Loops – Break statement – Continue Statement	2
III	Data Types in C – ASCII Code - Operators Expressions Associativity - Precedence of operators - Expression evaluation - Functions	2
IV	Arrays in C -Pointers in C -Programming using arrays and pointers -Sizeof operator - Returning pointers from functions – Recursion -Multidimensional Arrays and Pointers	2
V	Structures in C -Singly Linked Lists - Doubly Linked Lists - introduction -Organizing code into multiple files - Pre and post increment - File Handling	3
	Total Instructional hours	**10**

Reference: NPTEL- Introduction to Programming in C

https://onlinecourses.nptel.ac.in/noc19_cs42/preview

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Programme	Course Code	Name of the Course	L	T	P	C
MCA		**PROBLEM SOLVING AND PROGRAMMING**	10	0	0	0

Unit	Description	Instructional hours
I	**INTRODUCTION TO COMPONENTS OF COMPUTER SYSTEM** Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program	2
II	**ALGORITHMS & FLOWCHART** Introduction – The Problem-Solving aspect – Top-down Design - steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples.	2
III	**FUNDAMENTAL ALGORITHMS** Introduction – Exchanging the values – Counting – Factorial Computation – SINE computation – Base Conversion Generation of Fibonacci Sequence	2
IV	**FACTORING METHODS & ARRAY TECHNIQUES** Finding the Square root of a number – Smallest Divisor of an Integer – GCD – Prime Number – Raising a number to a large power. Array order reversal, Partitioning an Array, Longest Monotone Subsequence	2
V	**SORTING AND SEARCHING** Two-way Merge – Sorting by Selection – Sorting by Exchange – Sorting by Insertion – Sorting by Diminishing Increment – Binary Search – Hash Searching	2
	Total Instructional hours	**10**

Reference : R.Geoff Dromey, How To Solve It By Computer-Problem Solving And Programming,

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA1002	C PROGRAMMING LAB	0	0	3	1.5

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 C Program to Display Characters from A to Z Using Loop	3
5.	Write a C Program to Find G.C.D Using Recursion	3
6.	Write a C Program to Check Whether a Number is Palindrome or Not	6
7.	Write a C Program to Make a Simple Calculator Using switch...case	3
8.	C Program to Display Fibonacci Sequence	3
9.	C Program to Swap Two Numbers	3
10.	Write a program to get the total number of students and marks in a subject and write a program to count the number of students belonging to each of the following groups of marks 0-9,10-19-20-29,....90-100	3
11.	Write a program to search a given element in array using linear search.	6
12.	To find the smallest and largest element from a given array	
13.	To calculate the rowwise , columnwise and grand total of a given matrix	
14.	Write a program to count the vowels and letters in free text given as standard input. Read text a character at a time until you encounter end-of-data. Then print out the number of occurrences of each of the vowels a, e, i, o and u in the text, the total number of letters, and each of the vowels as an integer percentage of the letter total. Suggested output format is: Numbers of characters: a 3 ; e 2 ; i 0 ; o 1 ; u 0 ; rest 17 Percentages of total: a 13% ; e 8% ; i 0% ; o 4% ; u 0% ; rest 73%	
15.	To Sort n numbers using bubble sort using function sub program	
	Total Instructional hours	**10**

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SEMESTER I

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20MA1101	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, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1201	UI DESIGN AND DEVELOPMENT	3	1	0	4

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

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

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

REFERENCE BOOKS :

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

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

R3. James Lee, 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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1202	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	**PRESENTATION LAYER & NETWORK SECURITY** Functions of Presentation Layers – Applications of Presentation Layer – 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 - BehrouzA.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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1251	JAVA PROGRAMMING	3	1	0	4

COURSE OBJECTIVE	1. To layout all essentials of Java and to make it for use. 2. To study OOPS , graphical environment in applets and handle exceptions 3. To implement various event handling mechanisms and to study about AWT tools. 4. To learn a plenty of classes in I/O Streams and use multi threading and JDBC 5. To implement RMI and Servlets in real world applications.

Unit	Description	Instructional hours
I	**ESSENTIAL JAVA** All about Java-Getting and installing java-Creating code files-Reserved words-creating application-compiling code-running code-commenting code-Variables, Arrays, Strings and Immediate Solutions-Operators, Conditionals, Loops and immediate solutions	12
II	**OOPS, APPLETS, EXCEPTION HANDLING** **OOPS:** Classes-Objects-Data Members-Methods and immediate solutions –Inheritance, Inner classes , Interfaces and immediate solutions-Creating Packages and JAR files-**Applets:** Applets with AWT-Applications-Exception Handling.	12
III	**EVENT HANDLING WITH SWING** **Swing:** Swing-Working with Swing –Swing Applet- Swing Application- Swing components- -Layout Managers	12
IV	**I/O HANDLING, MULTI THREADS, DATABASE** **I/O handling**: Streams, Readers, Writers and immediate solutions-Multiple threads-Joining Threads-Thread Priority-Synchronization-Communicating between threads-Suspending, Resuming, Stopping Threads-JDBC-Call Level Interface-Java & JDBC- JDBC Driver Models- Types of Driver Managers- Executing DDL & DML commands-Joins & Transactions.	12
V	**RMI, Servlet** **RMI:** Defining the functions of remote class as an interface- Writing the implementation and server classes- Implementing a remote interface- Providing an implementation for each remote methods- A client program that uses the remote service. **Servlet:** HTML- Intreface Servlet- HttpServlet Class- Servlet Programs- Servlet with I/O File- Servlet with JDBC(Oracle Driver)- Cookies- Session Handling.	12
	Total Instructional hours	**60**

COURSE OUTCOME	CO1: Able to understand the essentials of Java and loopings. CO2:Able to explore the skills in program development using OOPS, Applets & Exception handling. CO3:Able to experience the event handling mechanisms and to use GUI Interfaces using AWT. CO4: Able to implement I/O Stream classes and threads, as well to connect databases. CO5: Able to connect client with server using RMI and to use web apps in servlets.

REFERENCE BOOKS :

R1. Steven Holzner et al- Java 2 Programming Black Book- New edition- Paraglyph Press, USA-2009.

R2. K. Somasundaram- Advanced Programming in Java2 with Swing, Servlet and RMI- Jaico Publishing House- 2008.

R3. C. Xavier- Java Programming- A Practical Approach- TMG Hill Education Pvt Ltd- 2012.

R4. Rashmi Kanta Das- Core Java for Beginners- Vikas Publishing House Pvt Ltd- 2009.

R5. Paul Deitel, Harvey Deitel-Java How to program Ninth Edition-PHI Learning Pvt Ltd., New Delhi

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1252	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 Block chain 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	**BLOCK CHAIN DATABASES** Overview – Block Chain Properties – Achieving block chain via cryptographic functions – consensus – data management in block chain – smart contracts – Performance enhancements.	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 Block Chain Databases.

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- McGrawHill 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).

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1001	JAVA PROGRAMMING LAB	0	0	3	1.5

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

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

6	**EXCEPTION HANDLING** i) Demonstrate ArithmeticException, ArrayIndexOutOfBoundsException, Multiple Catch Clauses, Catching subclass Exception, Nested try, throwing an exception, finally, throws. ii) Custom Exception: Consider a simple Student class with only three attributes name, mark and result. In this class we are going to define a constructor and findAndDisplayResult()method. This method will check whether the mark is < 50. If so, the candidate fails and otherwise he passes. The method must also do data validation work. If the mark is greater than 100, it means that some typographical error has occurred. So, the method must throw an exception MarkOutOfBoundsException. This exception has only one attribute called mark. Develop a custom exception as mentioned.	3
7	**EVENT HANDLING WITH SWING** **i)**Create a GUI form for a customer in car show room to input/select the car model and other specifications and display the details read. Utilise maximum possible swing components to demonstrate event handling. **ii)Adapter Class:** Using the Adapter class MouseAdapter, execute mousePressed and mouserReleased events.	3
8	**I/O** Write a program that copies a text file. The names of the source and destination files are specified on the command line.	3
9	**MULTITHREADING** i) Create a main thread that can spawn three child threads. ii) Demonstrate synchronization by controlling access to a method sumArray() which sums the elements of an integer array for 2 child threads.	6
10	**DATABASE** Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so.	3
11	**RMI** Write a class called ForEx with methods for doing the currency conversion operations(Rupees to USDollar, to UKPound, to SGDollar, to UAE Dhirams). Have this class as a servant and create a server program and register it in the rmiregistry. Write a client program to invoke these remote methods of the servant and do the calculations.	3
12	**SERVLET** Write a server/client program to create student details with the following attributes: Register number, Name of the student, Mark in sub1, Mark in sub2, Mark in sub3, Total marks. Store them in mark table of a database(Oracle/MySQL/SQL Server). The total of the three marks should be calculated only if the student passes all the 3 subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects, his total marks must be declared as 0. The servlet must display result in a table form with name, reg.no and result.	6
Total Instructional hours		**45**

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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA1002	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	Draw ER Diagram for an Application.	6
2	Construct DFD for an Application.	6
3	Execute a DDL, DML, DCL and TCL commands for a Table	3
5	Execute SQL Functions	3
6	Execute various Joins and Sub Queries	3
7	Given an Scenario, Apply Normalization at all levels.	6
8	Write PL/SQL Procedure for an application using Exception Handling	3
9	Write PL/SQL Procedure for an application using Cursors.	3
10	Write a PL/SQL program for an application using Functions.	3
11	Write a PL/SQL block for transaction operations of a typical application using Triggers	3
12	Getting Started with Block chain Ethereum	6
	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..

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20AC1171	COMMUNICATION SKILL FOR BUSINESS ENGLISH	2	0	0	2

COURSE OBJECTIVE	1. To understand the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents 2. Able to know about how to build the software systems that behave intelligently 3. Able to think, learn, understand, decide, perform on a problem and trying to solve real life. 4. To understand and also able to learn about neural networks and its features of neural networks 5. Able to know about the growing technologies in Robotics and impacts of Robotics

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 and Problem solving approach to AI problems CO2: Analyze the various search strategies for a Problem CO3: Evaluate different knowledge representation schemes for typical AI problems CO4: Examine the importance of security standards and the challenges in managing information technology CO5: Design and Implement a futuristic AI Applications

BOS CHAIRMAN   PRINCIPAL

BRIDGE COURSE – EVEN SEMESTER

Programme	Course Code	Name of the Course	L	T	P	C
MCA		OBJECT ORIENTED PROGRAMMING	10	0	0	0

Unit	Description	Instructional hours
I	Introduction to C++ - Programs with IO and Loop - Arrays and Strings – Sorting and Searching – Stack and its Applications - Constants and Inline Functions	2
II	Reference and Pointer - Default Parameters and Function Overloading -Operator Overloading - Dynamic Memory Management	2
III	Classes and Objects -Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator	2
IV	Constness - Static Members - friend Function and friend Class - Overloading Operator for User Defined Types-Namespace -Inheritance	2
V	Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions –Template -Closing Comments	2
	Total Instructional hours	**10**

Reference : NPTEL –

Programming in C++

https://nptel.ac.in/courses

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA1201	COMPUTER ORGANIZATION AND ARCHITECTURE	10	0	0	0

COURSE OBECTIVE	CO1 :To impart the knowledge in the field of digital electronics
	CO2: To impart knowledge about the various components of a computer and its internals.
	CO3: To design and realize the functionality of the computer hardware with basic gates and other components using combinational and sequential logic.
	CO4: To understand the importance of the hardware-software interface
	CO5: To understand the Input and Output design methods

Unit	Description	Instructional hours
I	**DIGITAL FUNDAMENTALS** Number Systems and Conversions – Boolean Algebra and Simplification – Minimization of Boolean Functions – Karnaugh Map, Logic Gates – NAND – NOR Implementation.	8
II	**COMBINATIONAL AND SEQUENTIAL CIRCUITS** Design of Combinational Circuits – Adder / Subtractor – Encoder – Decoder – MUX / DEMUX – Comparators, Flip Flop – Triggering – State Diagram and Minimization – Counters – Registers.	10
III	**BASIC STRUCTURE OF COMPUTERS & PARALLEL PROCESSING** Functional Units – Basic Operational Concepts – Bus Structures – Performance and Metrics – Instruction and Instruction Sequencing – Addressing Mode – ALU design – Fixed point and Floating point operation.	9
IV	**PROCESSOR DESIGN** Processor basics – CPU Organization – Data path design – Control design – Basic concepts – Hard wired control – Micro programmed control – Pipeline control – Hazards – super scalar operation	9
V	**MEMORY, I/O SYSTEM AND PARALLEL PROCESSING** Memory technology – Memory systems – Virtual memory – Caches – Design methods – Associative memories – Input / Output system – Programmed I/O – DMA and Interrupts– Multiprocessor Organization	9
	Total Instructional hours	**45**

COURSE OUTCOME	CO1 : Able to design digital circuits by simplifying the Boolean functions.
	CO2 : Able to understand the organization and working principle of computer hardware components.
	CO3 : Able to understand mapping between virtual and physical memory.
	CO4 : Acquire knowledge about multiprocessor organization and parallel processing
	CO5 : Able to trace the execution of an instruction through the processor.

REFERENCE BOOKS :

R1. Morris Mano, "Digital Design", Prentice Hall of India, Fourth Edition 2007.

R2. Carl Hamacher, Zyonko Vranesic, Safwat Zaky and Naraig Manjikian, " Computer Organization and Embedded Systems", Sixth Edition, Tata Mc Graw Hill, 2012.

R3. William Stangling, "Computer Organization & Architecture – Designing for Performance" 9th Edition 2012.

R4. David A. Patterson and John L. Hennessy, " Computer Organization and Design: The Hardware / Software Interface", Fourth Edition, Morgan Kaufmann/Elsevier, 2009.

R5. John P. Hayes, " Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 2014.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA2001	OOPS Laboratory	0	0	10	0

S.no	Description of the experiments	Practical hours
1.	Write a C++ program to perform String Concatenation • using Arrays • Using Functions • Using Arrays & functions • Using Pointers & Functions	3
2.	Write a C++ Program to illustrate Enumeration and Function Overloading	3
3.	Implementation of ADT such as Stack and Queues	3
4.	Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading	3
5.	Write a program to Illustrate Friend Function and Friend Class	3
6.	Write a Program to illustrate Static member and methods	3
7.	Write a Program to overload as binary operator, friend and member function	3
8.	Write C++ Programs and incorporating various forms of Inheritance	3
9.	Write a C++ Program to illustrate Virtual functions	3
10.	Write a C++ program to illustrate Exception Handling	3
	Total Instructional hours	**45**

BOS CHAIRMAN   PRINCIPAL

SEMESTER 2

Programme	Course Code	Name of the Course	L	T	P	C
MCA		SOFTWARE ENGINEERING	10	0	0	0

Unit	Description	Instructional Hours
I	**INTRODUCTION** Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model – fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification .	2
II	**SOFTWARE DESIGN** Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Jackson System development – Designing for reuse – Programming standards	2
III	**SOFTWARE TESTING AND MAINTENANCE** Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State based Testing - Testing Tools – Test Case Management – Software Maintenance Organization – Maintenance Report – Types of Maintenance	2
IV	**SOFTWARE METRICS** Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards	2
V	**SCM & WEB ENGINEERING** Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – CASE Repository – Features –Web Engineering	2

REFERENCE BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner Approach", Seventh edition, McGrawHill, 2010.

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

3. Ali Behforroz, Frederick J.Hudson, "Software Engineering Fundamentals", Oxford Indian Reprint, 2012

4. Sommerville, "Software Engineering", Sixth Edition, AddisonWesley-Longman, 2004.

5. Kassem A. Saleh, "Software Engineering", First Edition, J.Ross Publishing, 2009.

6. Pankaj Jalote, "An Integrated approach to Software Engineering", Third Edition, Springer Verlag, 2005.

BOS CHAIRMAN   PRINCIPAL

Progaamme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1201	UI DESIGN AND DEVELOPMENT	3	1	0	4

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

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

REFERENCE BOOKS :

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

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

R3. James Lee, 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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1202	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	**PRESENTATION LAYER & NETWORK SECURITY** Functions of Presentation Layers – Applications of Presentation Layer – 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 - BehrouzA.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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1251	JAVA PROGRAMMING	3	1	0	4

COURSE OBJECTIVE	1. To layout all essentials of Java and to make it for use. 2. To study OOPS , graphical environment in applets and handle exceptions 3. To implement various event handling mechanisms and to study about AWT tools. 4. To learn a plenty of classes in I/O Streams and use multi threading and JDBC To implement RMI and Servlets in real world applications.

Unit	Description	Instructional hours
I	**ESSENTIAL JAVA** All about Java-Getting and installing java-Creating code files-Reserved words-creating application-compiling code-running code-commenting code-Variables, Arrays, Strings and Immediate Solutions-Operators, Conditionals, Loops and immediate solutions	12
II	**OOPS, APPLETS, EXCEPTION HANDLING** **OOPS:** Classes-Objects-Data Members-Methods and immediate solutions –Inheritance, Inner classes , Interfaces and immediate solutions-Creating Packages and JAR files-**Applets:** Applets with AWT-Applications-Exception Handling.	12
III	**EVENT HANDLING WITH SWING** **Swing:** Swing-Working with Swing –Swing Applet- Swing Application- Swing components- -Layout Managers	12
IV	**I/O HANDLING, MULTI THREADS, DATABASE** **I/O handling**: Streams, Readers, Writers and immediate solutions-Multiple threads-Joining Threads-Thread Priority-Synchronization-Communicating between threads-Suspending, Resuming, Stopping Threads-JDBC-Call Level Interface-Java & JDBC- JDBC Driver Models- Types of Driver Managers- Executing DDL & DML commands-Joins & Transactions.	12
V	**RMI, Servlet** **RMI:** Defining the functions of remote class as an interface- Writing the implementation and server classes- Implementing a remote interface- Providing an implementation for each remote methods- A client program that uses the remote service. **Servlet:** HTML- Intreface Servlet- HttpServlet Class- Servlet Programs- Servlet with I/O File- Servlet with JDBC(Oracle Driver)- Cookies- Session Handling.	12
	Total Instructional hours	**60**

COURSE OUTCOME	CO1: Able to understand the essentials of Java and loopings. CO2:Able to explore the skills in program development using OOPS, Applets & Exception handling. CO3:Able to experience the event handling mechanisms and to use GUI Interfaces using AWT. CO4: Able to implement I/O Stream classes and threads, as well to connect databases. CO5: Able to connect client with server using RMI and to use web apps in servlets.

REFERENCE BOOKS :

R1. Steven Holzner et al- Java 2 Programming Black Book- New edition- Paraglyph Press, USA-2009.

R2. K. Somasundaram- Advanced Programming in Java2 with Swing, Servlet and RMI- Jaico Publishing House-2008.

R3. C. Xavier- Java Programming- A Practical Approach- TMG Hill Education Pvt Ltd- 2012.

R4. Rashmi Kanta Das- Core Java for Beginners- Vikas Publishing House Pvt Ltd- 2009.

R5. Paul Deitel, Harvey Deitel-Java How to program Ninth Edition-PHI Learning Pvt Ltd., New Delhi

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1252	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

COURSE OBJECTIVE	6. To remember the fundamentals of Database Management Systems and Relational Model. 7. To understand the concepts of Relational Algebra and SQL queries. 8. To make the students to understand the Schemas and Normalization. 9. To understand Transaction Management and Concurrency Control. 10. To understand Block chain 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	**BLOCK CHAIN DATABASES** Overview – Block Chain Properties – Achieving block chain via cryptographic functions – consensus – data management in block chain – smart contracts – Performance enhancements.	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 Block Chain Databases.

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- McGrawHill 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).

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1001	JAVA PROGRAMMING LAB	0	0	3	1.5

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

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

6	**EXCEPTION HANDLING** i) Demonstrate ArithmeticException, ArrayIndexOutOfBoundsException, Multiple Catch Clauses, Catching subclass Exception, Nested try, throwing an exception, finally, throws. ii) Custom Exception: Consider a simple Student class with only three attributes name, mark and result. In this class we are going to define a constructor and findAndDisplayResult()method. This method will check whether the mark is < 50. If so, the candidate fails and otherwise he passes. The method must also do data validation work. If the mark is greater than 100, it means that some typographical error has occurred. So, the method must throw an exception MarkOutOfBoundsException. This exception has only one attribute called mark. Develop a custom exception as mentioned.	3
7	**EVENT HANDLING WITH SWING** **i)**Create a GUI form for a customer in car show room to input/select the car model and other specifications and display the details read. Utilise maximum possible swing components to demonstrate event handling. **ii)Adapter Class:** Using the Adapter class MouseAdapter, execute mousePressed and mouserReleased events.	3
8	**I/O** Write a program that copies a text file. The names of the source and destination files are specified on the command line.	3
9	**MULTITHREADING** i) Create a main thread that can spawn three child threads. ii) Demonstrate synchronization by controlling access to a method sumArray() which sums the elements of an integer array for 2 child threads.	6
10	**DATABASE** Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so.	3
11	**RMI** Write a class called ForEx with methods for doing the currency conversion operations(Rupees to USDollar, to UKPound, to SGDollar, to UAE Dhirams). Have this class as a servant and create a server program and register it in the rmiregistry. Write a client program to invoke these remote methods of the servant and do the calculations.	3
12	**SERVLET** Write a server/client program to create student details with the following attributes: Register number, Name of the student, Mark in sub1, Mark in sub2, Mark in sub3, Total marks. Store them in mark table of a database(Oracle/MySQL/SQL Server). The total of the three marks should be calculated only if the student passes all the 3 subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects, his total marks must be declared as 0. The servlet must display result in a table form with name, reg.no and result.	6
Total Instructional hours		**45**

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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA1002	DBMS LABORATORY	0	0	3	1.5

COURSE OBJECTIVE	6. To give a better insight about ER and DFD. 7. To develop conceptual understanding of database management system 8. To understand how a real world problem can be mapped to schemas 9. To develop understanding of different applications and constructs of SQL, PL/SQL. 10. To introduce the concepts of transactions and transaction processing

S.no	Description of the experiments	practical hours
1	Draw ER Diagram for an Application.	6
2	Construct DFD for an Application.	6
3	Execute a DDL, DML, DCL and TCL commands for a Table	3
5	Execute SQL Functions	3
6	Execute various Joins and Sub Queries	3
7	Given an Scenario, Apply Normalization at all levels.	6
8	Write PL/SQL Procedure for an application using Exception Handling	3
9	Write PL/SQL Procedure for an application using Cursors.	3
10	Write a PL/SQL program for an application using Functions.	3
11	Write a PL/SQL block for transaction operations of a typical application using Triggers	3
12	Getting Started with Block chain Ethereum	6
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..

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20AC1171	COMMUNICATION SKILL FOR BUSINESS ENGLISH	2	0	0	2

COURSE OBJECTIVE	6. To understand the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents 7. Able to know about how to build the software systems that behave intelligently 8. Able to think, learn, understand, decide, perform on a problem and trying to solve real life. 9. To understand and also able to learn about neural networks and its features of neural networks 10. Able to know about the growing technologies in Robotics and impacts of Robotics

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 and Problem solving approach to AI problems CO2: Analyze the various search strategies for a Problem CO3: Evaluate different knowledge representation schemes for typical AI problems CO4: Examine the importance of security standards and the challenges in managing information technology CO5: Design and Implement a futuristic AI Applications

BOS CHAIRMAN   PRINCIPAL

SEMESTER - II

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20MA2101	MATHEMATICS FOR COMPUTER APPLICATIONS	3	1	0	4

COURSE OBJECTIVE	1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications. 2. Extend the knowledge of vector spaces 3. Solve algebraic, transcendental and system of linear equations by using various techniques. 4. Understand the concept of differentiation. 5. Evaluate the functions of several variables which are needed in many branches of engineering

Unit	Description	Instructional hours
I	**MATRIX ALGEBRA:** Matrix - linear dependence - rank of a matrix - consistency of system of linear equations - solution of linear system of equations - characteristic equations - eigen values and eigen vectors - diagonalization - singular value decomposition.	12
II	**VECTOR SPACES:** Vector space - basis - span - orthogonality - orthonormality -Inner product spaces. Complex matrices – Conjugate of the matrix – Hermitian and Skew Hermitian matrices – Properties (without proof) – Unitary matrix – Properties (without proof).	12
III	**SOLUTION OF LINEAR EQUATIONS:** Solution of linear system (Ax=B) by Gauss Elimination and Gauss Jordan method – Iterative method : Gauss seidel method. Inverse of matrix by Gauss Jordan method - Matrix factorization concept/LU decomposition	12
IV	**DIFFERENTIAL CALCULUS:** Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem.	12
V	**MULTIVARIATE CALCULUS(DIFFERENTIATION):** Partial derivatives - Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange's method of undetermined multipliers – Gradient, divergence, curl and derivatives.	12
	Total Instructional hours	**60**

COURSE OUTCOME	CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies CO2: Infer the knowledge of vector spaces CO3: Solve the system of linear algebraic equations representing steady state models and non linear equations arising in the field of engineering. CO4: Apply the concept of differentiation in any curve. CO5: Identify the maximum and minimum values of surfaces.

TEXT BOOKS:
1. T1- Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2018.
2. Sankara Rao K, "Numerical Methods for Scientists and Engineers", 3rd edition, Prentice Hall of India Private limited, New Delhi,2007..
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

REFERENCE BOOKS:

R1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications(p) Ltd. (2007)

R2. Grewal B.S. and Grewal J.S. " Numerical Methods in Engineering and Science ", 6th Edition , Khanna publishers, New Delhi 2004.

R3. Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2201	DATA STRUCTURES AND ALGORITHMS	3	1	0	4

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

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

COURSE OUTCOME	CO1: Able to understand the fundamental topics of linear data structures Arrays, Pointers, Structures, Linked Lists, Stack and queues. CO2: Able to understand different implementation and algorithms related to searching, sorting and Hashing methods. CO3: Able to understand the concept of important data structure like Trees and Graphs. CO4: Able to understand various algorithmic strategies. CO5: Able to build a complete algorithmic solution to a given problem.

REFERENCE BOOKS :

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed- Fundamentals of Data Structures in C – Second Edition- University Press India Pvt Ltd, Hyderabad- 2008.
2. Yashavant Kanetkar- Data Structures through C- Second Edition- BPB Publications, India- 2009.
3. S. K. Srivastava & Deepali Srivastava-Data Structures through C in Depth-Second Revised & Updated Edition- BPB Publications, New Delhi- 2011
4. A. Puntambekar- Data Structures and Algorithms- Second Revised Edition- Technical Publications, Pune- 2010.

5. (For Problems)Seymour Lipschutz- Data Structures with C- Schaum's Outlines- Special Indian Edition- Tata McGrawHill Education(India) Pvt Ltd, Chennai- 20th reprint 2017.
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman- Data Structures and Algorithms- Seventh Impression- Pearson Education, Noida- 2011.
7. Ashok N. Kamthane- Introduction to Data Structures in C- Seventh Impression- Dorling Kindersley India Pvt Ltd, Noida- 2011.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2151	PYTHON PROGRAMMING	3	0	0	3

COURSE OBJECTIVE	1. Develop an understanding on the basic concepts of Python Fundamentals 2. To understand Functions, File operations, Classes, Objects and regular Expressions. 3. To understand data analytics and various tools for its usage. 4. To Perform Exploratory Data Analysis, Data Preparation and Preprocessing 5. To Perform case Studies using Classification &Regression

Unit	Description	Instructional Hours
I	**FUNDAMENTALS** Python Fundamentals – Data Types –Basics of Python Spyder - Conditional Statements – Looping& Iteration – String Manipulation – Lists – Tuple – Dictionaries - Sets, Range	9
II	**CORE PYTHON** Introduction to Functions – Built in & User Defined Functions – Modules and Packages, Classes & Objects – Regular Expressions, Errors & Exceptions	9
III	**DATA ANALYTICS 1** Introduction to data Analytics – Why? Python for Data Analysis – Libraries for data Analytics – Jupyter Notebook – Numpy – Scipy – Matplot Lib	9
IV	**DATA ANALYTICS 2** Pandas –Data Frame related operations – Grouping – Summary Tables - Seaborn – Web Scraping - Reading Files, Exploratory Data Analysis – Data Preparation and Pre processing	9
V	**ML ALGORITHMS** Machine Learning – Supervised ML & Un Supervised ML, SCI-KIT Learn , Regression, Classification, Case Study on Regression and Classification	9
	Total Instructional Hours	**45**

COURSE OUTCOME	CO1: Understand the basic concepts of Python Fundamentals. CO2: Design applications using Functions, Files, Modules, Classes and Objects & Regular Expressions. CO3: To Implement Libraries for data Analytics. CO4: To Implement Exploratory Data Analysis , Data Preparation and Preprocessing CO5: To Implement Case Studies using Classification and Regression Model.

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 - Jake VanderPlas, Python Data Science Handbook, Essential Tools for Working with Data, O'Reilly Media, Inc., 2017

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2152	DATA ANALYTICS USING R PROGRAMMING	3	1	0	4

COURSE OBJECTIVE	1. To understand the basic things about data analytics and R Programming 2. To Understand the Basics of R Programming and its Data Structure 3. To understand the data visualization techniques and Debugging 4. To Know the basics of Statistics used in R Programming 5. To understand the data analytics algorithms.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BUSINESS ANALYTICS& R** Introduction to Business Analytics & its Features - Types of Business Analytics - Business Analytics Case Studies - Business Decisions - Business Intelligence - Data Science and its importance– Introduction to R – Understanding R -Using R to illustrate the basic concepts - Installing R and RStudio - Scripting in R – R Workplace and Packages - Distributed R	12
II	**R PROGRAMMING & DATA STRUCTURE** Introduction - Operators in R - Basic and Advance Data Types - Loops and Conditional Statement in R - Commands to Run an R Script and a Batch –Functions in R - String Manipulation in R - Dplyr Package – An Overview - Installing Dplyr – Functions of the Dpylr package- Types of Data Structures in R - Vectors – Scalars - Matrices – Arrays – Data Frames - List	12
III	**DATA VISUALIZATION & DEBUGGING** Introduction to Graphics in R - Types of Graphics - Basic elements of graph – Methods to Save Graphics as Files – Procedure to Export Graphs in R Studio - Introduction to Debugging - Important Function to Debug	12
IV	**STATISTICS IN R** Introduction to Statistics - Types of Data Qualitative vs Quantitative Analysis - Hypothesis Testing in R - Need of Hypothesis Testing in Businesses - Test of mean - Test of variance - Chi-square Test - Non-parametric Test	12
V	**ANALYTICS ALGORITHMS** Linear regression: simple linear regression, introduction to multiple linear regression - Classification: logistic regression, decision trees, SVM -Ensemble methods: bagging, random forests, boosting.	12
	Total Instructional Hours	**60**

COURSE OUTCOME	CO1: Understanding the Business Analytics and Basics of R programming. CO2: Implementation of R Programming and various Data Structures. CO3: Implementation of Data Visualization using R programming. CO4:Implement the various Statistics tools used in R Programming CO5: Implementation of Case Study Representation.

REFERENCE BOOKS:

R1 : Seema Acharya, Data Analytics Using R , Tata Mc Graw Hill, 2018.

R2 : Anil Maheshwari, Data Analytics, Tata Mc Graw Hill 2017.

R3: Kieran Healy, Data Visualization A Practical Introduction, Princeton University Press 2018.

R4 : Using R for Introductory Statistics, John Verzani, Taylor & Francis, 2018

R5 : Hands on Machine Learning with R, Brad Boehmke, Brandon M Greenwell, CRC Press, 2019

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2001	PYTHON PROGRAMMING LAB	0	0	3	1.5

COURSE OBJECTIVE	1. To develop Python programs using basic data types and Data Structures. 2. To develop Python programs using Functions, classes, Errors & Exceptions & Regular Expressions 3. To Understand the various tools of data analytics 4. To perform exploratory data analysis using Pandas 5. To develop Model for Regression and Classification Algorithms.

S.no	Description of the experiments	practical hours
1	Implement Python programs using basic data types, data structures in Python	6
2	Implement Python programs using Function, Classes and Objects, Errors & Exceptions	6
3	Implement a validation code using Regular Expression for any case scenario	3
4	Implementation of data Analytics tool such as Numpy, Scipy and Matplot Lib	3
5	Plotting and analyzing a data set using Numpy and MatPlot Lib using a case study	6
6	Perform Exploratory Data analysis using Pandas for a given Data set	6
7	Case Study on Regression Problem with a given data set	6
8	Case Study on Classification Problem with a given data set	6
	Total Instructional hours	**45**

COURSE OUTCOME	CO1: Ability to develop python programs using data structures CO2: Ability to code using functions, classes & Objects, and Error Handling CO3: Ability to deploy various Data analytics tools for a problem set CO4: Able to develop Python programs by analyzing data sets using pandas. CO5: Ability to Apply various classification and Regression Algorithms for given data set.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2002	DATA STRUCTURE AND ALGORITHMS LAB	0	0	3	1.5

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

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

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

BOS CHAIRMAN   PRINCIPAL

SEMESTER –III

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3201	DATA MINING AND DATA WAREHOUSING	3	0	0	3

COURSE OBJECTIVE	1. To understand data warehouse concepts, architecture, business analysis and tools 2. To understand data pre-processing and data visualization techniques 3. To study algorithms for finding hidden and interesting patterns in data 4. To understand and apply various classification and clustering techniques using tools. 5. To Know the usage of WEKA tool

Unit	Description	Instructional Hours
I	**DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)** Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.	9
II	**DATA MINING – INTRODUCTION** Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.	9
III	**DATA MINING – FREQUENT PATTERN ANALYSIS** Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns	9
IV	**CLASSIFICATION AND CLUSTERING** Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –– Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.	9
V	**WEKA TOOL** Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.	9
	Total Instructional Hours	**45**

Course Outcome	CO1: Design a Data warehouse system and perform business analysis with OLAP tools. CO2:Apply suitable pre-processing and visualization techniques for data analysis CO3:Apply frequent pattern and association rule mining techniques for data analysis CO4:Apply appropriate classification and clustering techniques for data analysis CO5: Usage of WEKA tool

REFERENCE BOOKS:
R1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

R2. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.

R3. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

R4. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

BOS CHAIRMAN   PRINCIPAL

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

COURSE OBJECTIVE	1. To understand what operating system is and summaries the hardware, software resources and define the fundamental notion of process.
	2. To discuss threads, the issues of concurrency encountered in multi programmed systems and introduce the disastrous consequences of waiting, deadlock and indefinite postponement.
	3. To discuss concepts and algorithms related to allocating processor time to processes and to present how real memory operating systems have organized physical memory resources.
	4. To understand virtual memory concepts and the hardware capabilities that supports virtual memory.
	5. To understand the techniques which OS employ to manage data on secondary storage.

Unit	Description	Instructional hours
I	**INTRODUCTION TO OS, HARDWARE AND SOFTWARE CONCEPTS, PROCESSES** **OS, Hardware and Software:** What is an Operating System?- OS components and goals- Architecture- Hardware components & its support for OS- Caching and buffering- APIs, Firmware and Middleware- Process States and Management- Interrupts- Inter process Communication	12
II	**THREADS, ASYNCHRONOUS AND CONCURRENT EXECUTION, DEADLOCK** Thread Definition- States, Operations and Models- Mutual Exclusion- S/w H/w solutions- Semaphores -Monitors. Deadlock Examples- Four necessary conditions for deadlock- Deadlock solutions- prevention- Deadlock avoidance with Dijkstra's Bankers algorithm- Deadlock detection & recovery.	12
III	**PROCESSOR SCHEDULING, PHYSICAL MEMORY ORGANIZATION** Preemptive vs Non preemptive scheduling- Priorites and objectives - Scheduling Algorithms- Memory Management and strategies- Contiguous vs Noncontiguous memory allocation- Single user contiguous memory allocation- Fixed partition & Variable partition multiprogramming- Multiprogramming with memory swapping	12
IV	**VIRTUAL MEMORY ORGANIZATION AND MANAGEMENT** Virtual memory basic concepts- Block mapping- Paging and Segmentation systems- Locality- Demand paging- paging- Page replacement and Strategies- Page fault frequency page replacement- Page release- page size- Global vs Local page replacement.	12
V	**SECONDARY STORAGE AND FILES** Disk scheduling strategies- Caching and buffering- Other disk performance techniques- RAID- Data Hierarchy- File systems & organization- File Allocation- Free space management- File Access control- Data access techniques- data integrity protection.	12
	Total Instructional hours	**60**

COURSE OUTCOME	CO1: Able To understand the need for operating systems and know hardware support for OS, performance enhancement techniques and process structures in OS.
	CO2: Able To understand the relationship of threads to processes, critical sections, the need for mutual exclusion, how monitors synchronize access to data and the problem of deadlock.
	CO3: Able To understand the goals of processor scheduling and the need for real memory management.
	CO4: Able To understand paging systems, focusing on paging address translation, segmentation systems and how OS attempt to optimize virtual memory performance.
	CO5: Able To understand the evolution of disk scheduling strategies and know various file organizations and allocation techniques.

REFERENCES BOOKS:

R1. Rohit Khurana- Operating Systems- First Edition- Vikas Publishing House Pvt Ltd, Noida. 2011.

R2. (For problems)Archar J Harris- Operating Systems- 2nd Edition - Schaum's Outlines- Tata McGraw Hill Publishing Company Ltd, New Delhi- 2008

R3. William Stallings- Operating Systems Internals and Design Principles- Ninth Edition- Pearson India Education Services Pvt Ltd, Noida- 2018.

R4. Andrew S Tanenbaum, Albert S. Woodhull- Operating Systems Design and Implementation- Third Edition- PHI Learning Pvt Ltd, New Delhi- 2006

R5. Dhananjay M. Dhamdhere- Operating Systems- A concept based approach- Second Edition- Tata McGrawHill Publishing Company Ltd, New Delhi- 2006.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3151	WEB DEVELOPMENT	3	1	0	4

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

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

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

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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3152	ARTIFICIAL INTELLIGENCE	3	1	0	4

COURSE OBJECTIVE	1. To understand the fundamentals of Artificial Intelligence and Environment of the Intelligent Agents 2. Able to know about how to build the software systems that behave intelligently 3. Able to think, learn, understand, decide, perform on a problem and trying to solve real life. 4. To understand and also able to learn about neural networks and its features of neural networks 5. Able to know about the growing technologies in Robotics and impacts of Robotics

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE** Introduction to Artificial Intelligence - The History of Artificial Intelligence - Goals of Artificial Intelligence - Artificial Intelligence Techniques - Applications of Artificial Intelligence - What contributes to Artificial Intelligence - Real life Use cases in various industries **INTELLIGENT AGENTS AND ENVIRONMENTS** Agents and Environments - Agents Terminology - The Structure of Intelligent Agents - The Nature of environments - Properties of Environment - The concept of Rationality - What is ideal Rational Agent- **Intelligent Systems -**Introduction to Intelligence - Types of Intelligence - Its components	12
II	**ARTIFICIAL INTELLIGENCE SEARCH ALGORITHMS -**Search Terminologies - Single Agent Path finding problems - Graph Based Search - Brute-Force Search (Uninformed Search) - Heuristic Search (Informed Search) - Local Search Algorithms- **Fuzzy Logic Systems In Artificial Intelligence -**About Fuzzy Logic - Its System Architecture - Application of Fuzzy Logic Systems and relevant examples - Advantages and Disadvantages **EXPERT SYSTEMS** Overview - Typical Expert System Tasks - Its Characteristics and Advantages - Capabilities and Structure of Expert Systems - Facts and Rules (Procedures) - Components of Expert Systems - Knowledge Base -Inference Engine - User Interface - Expert Systems Development - Expert Systems Benefit and its limitations	12
III	**LEARNING** Forms of Learning - Supervised Learning - Learning Decision Trees - Artificial Neural Networks -What are Artificial Neural Networks - Structure of Artificial Neural Networks and its types - Single-layer feed-forward Artificial Neural Networks - Multilayer feed-forward Artificial Neural Networks - Working of Artificial Neural Networks - Application of Artificial Neural Networks	12
IV	**ARTIFICIAL INTELLIGENCE NATURAL LANGUAGE PROCESSING** Terminologies - Language Models - Information Retrieval - Information Extraction - Natural Languages vs. Computer languages - Components of Natural Language Processing - Problems in Natural Language Processing - Tasks Involved (Steps in Natural Language Processing) - Speech Recognition - **Perception -** Image Formation - Image Processing Operations - Object Recognition by Appearance - Object Recognition from Structural Information - Reconstructing the 3D World	12
V	**ROBOTICS** Introduction - What are Robots and its components - What is Robotics and its relevance to Artificial Intelligence - Robot Hardware -Sensors -Effectors - Robotic Perception - Robot Locomotion - Planning to Move - Planning -uncertain movements - Moving - Robotic Software Architecture - Application Areas of Robotics in Real life scenarios	12
	Total Instructional Hours	**60**

COURSE OUTCOME	CO1: Know the basics and Problem solving approach to AI problems
	CO2: Analyze the various search strategies for a Problem
	CO3: Evaluate different knowledge representation schemes for typical AI problems
	CO4: Examine the importance of security standards and the challenges in managing information technology
	CO5: Design and Implement a futuristic AI Applications

REFERENCE BOOKS :

R1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2016.

R2.I. Bratko, Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

R3. Gerhard Weiss, Multi Agent Systems, Second Edition, MIT Press, 2013.

BOS CHAIRMAN   PRINCIPAL

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

Team Project with a maximum of four in a team

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

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

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

COURSE OBJECTIVE	1.An ability to apply knowledge of computing and mathematics appropriate to the discipline 2.Able to analyze the given problem and identify and define the computing requirements appropriate to the discipline 3. Able to design, implement and evaluate computer based system, process, component, or program to meet the desired standards. 4. Able to implement various search algorithms using any of the programming languages. 5.An ability to use current techniques, skills, and tools necessary for computing practice

S. No	Program	Hours
1.	Write a program for Water Jug Problem	3
2.	Write a program for Breath First Search (BFS)	6
3.	Write a program for Depth First Search (DFS)	3
4.	Write a program for Depth First Iterative Deepening search (DFIDS)	3
5.	Write a program for Hill climb problem	6
6.	Write a program for Learning Decision Trees	3
7.	Write a program for Pure Heuristic search	6
8.	Write a program for A Star(A*) Search	3
9.	Write a program for Greedy Best First Search	6
10.	Write a program for Bi-Directional Search	6
	Total Hours	45

COURSE OUTCOME	CO1: Understand the fundamentals of knowledge representation CO2: Ability to apply the knowledge representation CO3: Able to implement various AI search algorithms.

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PROFESSIONAL ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2301	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. Harlon Carvey, Windows Registry forensics, Syngress, 2011
3. Andrew Hoog, Android forensics, Syngress,2011
4. Michael E Whitman and Herbert J Mattord, "Principles of information Security", Vikas Publishing House, New Delhi,2003.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2302	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. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies, August 2012.
3. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.
4. John Lamb, ―The Greening of IT, Pearson Education, 2009.
5. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2303	HUMAN COMPUTER INTERACTION	3	0	0	3

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

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

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

REFERENCE BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 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).

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2304	PROFESSIONAL ETHICS	3	0	0	3

COURSE OBJECTIVE	1. To learn about computer ethics in work environment. 2. To expose the threats in computing environment 3. To know the intricacies of accessibility issues 4. To ensure safe exits when designing the software projects 5. To comprehend the concepts of computer ethics in work environment.

Unit	Description	Instructional Hours
I	**HUMAN VALUES AND COMPUTER ETHICS 9** 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 9** 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 9** 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 9** 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: Remember the human values and computer ethics.
	CO2: Understand the computer crime and the related intellectual property rights
	CO3: Apply regulatory and safety concepts in internet.
	CO4: Understanding the computer technologies.
	CO5: Remember the models software development and quality standards.

REFERENCE BOOKS :

1. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical , legal and professional issues in computing", Middlesex University Press, 2008
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2011
3. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2011
4. Richard Spinello, "Case Studies in Information and Computer Ethics", Prentice Hall, 1997.
5. http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2305	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 Sites John Wiley & Sons, 2011.
2. Andrew Rapo, Alex Michael,"Understanding Macromedia Flash 8 ActionScript 2: Basic Techniques for Creatives"Focal press Taylorand Francis group, 2013
3. Andrew Faulkner, Conrad ChavezAdobe Photoshop CC Classroom in a Book (2017 release)

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2306	DIGITAL LOGIC AND COMPUTER ORGANIZATION	3	0	0	3

COURSE OBJECTIVE	1. To understand the fundamentals of Boolean logic and functions. 2. To design and realize digital systems with basic gates and other components using combinational and sequential circuits. 3. To study the instruction sets and operations of a processor. 4. To study the different ways of communication with I/O devices and standard I/O Interfaces. 5. To study the hierarchical memory system including cache memories and virtual memory.

Unit	Description	Instructional Hours
I	**DIGITAL FUNDAMENTALS** Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic 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:Be proficient in number systems and computer arithmetic. CO2:Design and implement digital systems with basic gates and other components using combinational and sequential circuits. CO3:Familiarize and understand the organization of memory hierarchies including the basics of cache design and subsystem. CO4:Understand a machine's Instruction Set Architecture (ISA) including basic instruction fetch and execute cycles, instruction formats and control flow. CO5:Understand a basic input/output functioning including program controlled I/O, interrupt I/O and analyze the performance of processors and caches.

REFERENCE BOOKS:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software   Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.

2. M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013.

3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.

5. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2008.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2307	PRINCIPLES OF PROGRAMMING LANGUAGE	3	0	0	3

COURSE OBJECTIVE	1. To understand and describe syntax and semantics of programming languages
	2. To understand data, data types, and basic statements
	3. To understand call-return architecture and ways of implementing them
	4. To understand object-orientation, concurrency, and event handling in programming languages
	5. To develop programs in non-procedural programming paradigms

Unit	Description	Instructional Hours
I	**SYNTAX AND SEMANTICS** Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-decent – bottom up parsing	9
II	**DATA, DATA TYPES AND BASIC STATEMENTS** Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixedmode assignments – control structures – selection – iterations – branching – guarded statements	9
III	**SUBPROGRAMS AND IMPLEMENTATIONS** Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping	9
IV	**OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING** Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – even handling	9
V	**FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES** Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages	9
	Total Instructional Hours	**45**

COURSE OUTCOME	CO1:Able to Describe syntax and semantics of programming languages
	CO2:Able to Explain data, data types, and basic statements of programming languages
	CO3:Able to Design and implement subprogram constructs
	CO4:Able to Develop programs in Scheme, ML, and Prolog
	CO5:Able to Understand and adopt new programming languages

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2308	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 Cases‖ Prentice Hall of India (P) Ltd., New Delhi, 2019

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3301	DATA SCIENCE	3	0	0	3

COURSE OBJECTIVE	1. To know the fundamental concepts of data science and analytics.
	2. To learn fundamental data analysis using R.
	3. To understand various data modeling techniques.
	4. To learn the basic and advanced features of open source big data tools and frameworks.
	5. To study various analytics on stream data.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DATA SCIENCE AND BIG DATA** Introduction to Data Science – Data Science Process – Exploratory Data analysis – Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution Of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting – Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization.	9
II	**DATA ANALYSIS USING R** Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.	9
III	**DATA MODELING** Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, MongoDB: RDBMS VsMongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase: Defining Schema – CRUD Operations	9
IV	**DATA ANALYTICAL FRAMEWORKS** Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce – Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.	10
V	**STREAM ANALYTICS** Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.	8
	Total Instructional Hours	**45**

COURSE OUTCOME	CO1: Convert real world problems to hypothesis and perform statistical testing.
	CO2: Perform data analysis using R.
	CO3: Work with big data platform and its analysis techniques.
	CO4: Identify and design efficient modeling of very large data.
	CO5: Implement suitable data analysis for stream data.

REFERENCE BOOKS:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

2. Umesh R Hodeghatta, Umesha Nayak, "Business Analytics Using R – A Practical Approach", Apress, 2017.

3. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

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

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

6. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly, 2013.

7. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley, 2014.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3302	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

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

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

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

REFERENCES BOOKS:

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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3303	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.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3304	CLOUD COMPUTING	3	0	0	3

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

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

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

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing , Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

BOS CHAIRMAN   PRINCIPAL

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

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

Unit	Description	Instructional Hours
I	**INTRODUCTION** Information technology and Business-E-Commerce-EDI-E-Commerce types-E-Commerce and World Wide Web-Internet Connectivity-E-Commerce – case studies leading the Transformation-E-Governance case studies leading the Transformation – - Internet communication protocols-Internet services and Resources-Internet Mail-Internet search-issues of concern-Browsers-HTML Java-Internet 2	9
II	**BULIDING BLOCKS FOR E-COMMERCE** Electronic Data Interchange - .costs and benefits – Components of EDI systems- EDI Implementation issues-Identification and tracking tools-The EAN, EANCOM- riticle numbering-bar coding – EAN location numbering –RFID-Business Process Reengineering-Approaches to BBR-Strategic alignment model-BBR Methodology-Management of change- change management – the change management in the government – the implementation plan	9
III	**CYBER SECURITY** Legal issues – Risks – paper documents vs Electronic document-technology for authenticating electronic document-Laws for E-Commerce - Cyber attack-hacking-firewalls-Intrusion Detection System-Secure Socket layer-authentication and assurance of data integrity-cryptography based solutions-digital signature-the protocols for secured messaging-guidelines for cryptography policy-Virtual Private Network.Cyber crimes 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-cyber crimes 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

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3306	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, "Organisational Behavior", McGraw Hill, 12th Edition, 2013.

R2 - Steven McShane and Mary Von Glinow , "Organizational Behavior", 4th Edition, 2019.

R3- Schermerhorn, Hunt and Osborn, "Organisational behavior", John Wiley, 9th Edition, 2011.

BOS CHAIRMAN   PRINCIPAL

Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA3307	DEEP LEARNING	3	0	0	3

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

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

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

REFERENCE BOOKS:

1. Ian J. Goodfellow, 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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