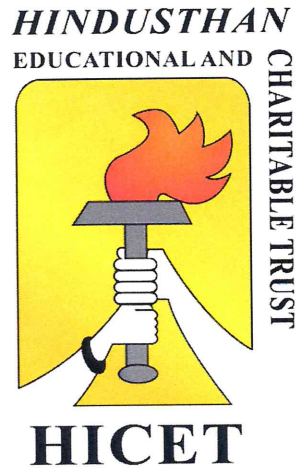


HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)
COIMBATORE 641 032

M.C.A. (COMPUTER APPLICATIONS)



(CHOICE BASED CREDIT SYSTEM)

Curriculum & Syllabus

2020-2021

VISION AND MISSION OF THE INSTITUTION

VISION

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

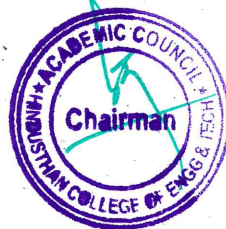
MISSION

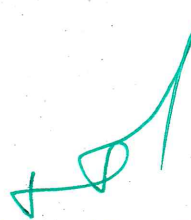
IM1: To provide academic excellence in technical education through novel teaching methods.

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

IM3: To produce dedicated professionals with social responsibility.


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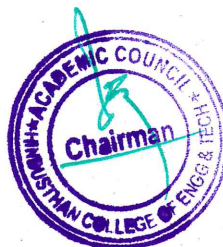

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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


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PO 9. **Communication Efficiency:** An ability to interchange information effectively through verbal and written form

PO10. **Societal and Environmental Concern:** An ability to assess the impact of computing on health, safety and culture

PO11. **Individual and Team Work :** Function effectively as an individual and as a member in team

PO12. **Innovation and Entrepreneurship:** An ability to adapt software engineering practices and to succeed as an employee or an entrepreneur.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Design application software projects to meet the demands of industry requirements using modern tools and technologies.

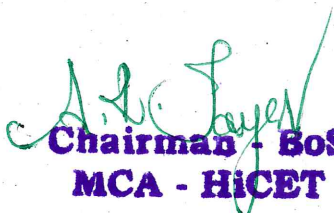
PSO 2. Analyze societal needs to provide solutions through technology based research.

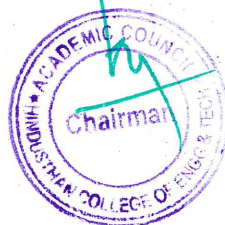
PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

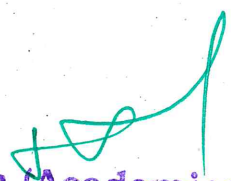
PEO 1. Take up career related to computer applications with required core competencies gained in an assessment driven learning environment.

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

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


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VISION AND MISSION OF THE DEPARTMENT

VISION

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

MISSION

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

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

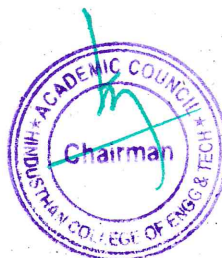
DM2: provide opportunity to faculty to upgrade their knowledge and skills related to computer applications for supporting the programs offered through their domain expertise.

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

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

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


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CURRICULUM

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS
CBCS PATTERN
POST GRADUATE PROGRAMMES
M.C.A MASTER OF COMPUTER APPLICATIONS
REGULATION-2016 & 2020**

REGULATION-2020

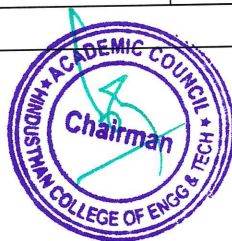
For the students admitted during the academic year 2020-2021 and onwards

SEMESTER I - BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	20CA1291	Programming in C	BRIDGE	3	0	0	0	100	0	100
2.	20CA1292	Problem Solving and Programming	BRIDGE	3	0	0	0	100	0	100
PRACTICAL										
3.	20CA1091	Programming in C Lab	BRIDGE	0	0	3	0	100	0	100
Total				6	0	3	0	300	0	300

SEMESTER I – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	20MA1101	Probability and Statistics, Operations Research	FC	3	1	0	4	40	60	100
2.	20CA1201	UI Design & Development	PC	3	1	0	4	40	60	100
3.	20CA1202	Computer Networks	PC	3	0	0	3	40	60	100
4.	20CA1203	Java Programming	IC	3	1	0	4	40	60	100
5.	20CA1204	Database Management Systems	IC	3	0	0	3	40	60	100
PRACTICAL										
6.	20CA1001	Java Programming Lab	EEC	0	0	3	1.5	50	50	100
7.	20CA1002	DBMS Lab	EEC	0	0	3	1.5	50	50	100
8.	20CA1171	Communication Skill for Business English	EEC	0	0	4	2	100	0	100
Total				15	3	10	23	400	400	800



SEMESTER II – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	20CA2291	Object Oriented Programming	BRIDGE	3	0	0	0	100	0	100
2.	20CA2292	Computer Organization and Architecture	BRIDGE	3	0	0	0	100	0	100
PRACTICAL										
3.	20CA2091	Object Oriented Programming Lab	BRIDGE	0	0	3	0	100	0	100
Total				6	0	3	0	300	0	300

SEMESTER II – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	20CA2201	Data Structures and Algorithms	PC	3	1	0	4	40	60	100
2.	20CA2202	Software Engineering	PC	3	0	0	3	40	60	100
3.	20CA2203	Python Programming	PC	3	1	0	4	40	60	100
4.	20CA2204	Data Science Using Python Programming	IC	3	1	0	4	40	60	100
5.	20CA23XX	Professional Elective -I/ NPTEL /EDX	PE	3	0	0	3	40	60	100
6.	20CA1001	L/S/MOOC	EEC	2	0	0	2	100	0	100
PRACTICAL										
7.	20CA2001	Python Programming Lab	EEC	0	0	3	1.5	50	50	100
8.	20CA2002	Data Structures & Algorithms Lab	EEC	0	0	3	1.5	50	50	100
9.	20CA2801	Internship / Industrial Training	EEC	0	0	0	2	100	0	100
Total				17	3	6	25	500	400	900

REGULATION – R2016

**For the students admitted during the academic year 2019-2020 and onwards
SEMESTER III**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16BA3251	Organizational Behaviour	3	0	0	3	40	60	100
2	16CA3201	Computer Networks	3	0	0	3	40	60	100
3	16CA3202	Compiler Design and Analysis	3	0	0	3	40	60	100
4	16CA3203	Java Programming	3	0	0	3	40	60	100



5	16CA3204	Computer Graphics and Multimedia	3	0	0	3	40	60	100
PRACTICAL									
6	16CA3001	Software Engineering Tools Laboratory	0	0	4	2	50	50	100
7	16CA3002	Java Programming Laboratory	0	0	4	2	50	50	100
8	16CA3003	Computer Graphics and Multimedia Laboratory	0	0	4	2	50	50	100
9	16CA3004	Career & Soft Skill Development - I	0	0	2	1	50	50	100
Total			15	0	11	22	400	500	900

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CA4201	Operation Research	3	1	0	4	40	60	100
2	16CM4321	Embedded Systems	3	0	0	3	40	60	100
3	16CA4202	Network Programming	3	0	0	3	40	60	100
4	16CA43XX	Professional Elective I	3	0	0	3	40	60	100
5	16CA43XX	Professional Elective II	3	0	0	3	40	60	100
PRACTICAL									
6	16CM4001	Embedded Systems Laboratory	0	0	4	2	50	50	100
7	16CA4002	Network Programming Laboratory	0	0	4	2	50	50	100
8	16CA4003	Career & Soft Skill Development - II	0	0	2	1	50	50	100
9	16CA4701	Technical Seminar/ Technical Publications	0	0	4	2	50	50	100
Total			15	1	11	23	400	500	900

LIST OF PROFESSIONAL ELECTIVES

ELECTIVE – I & II COMMON									
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1.	16CA4301	TCP/IP	3	0	0	3	40	60	100
2.	16CA4302	Software Project Management	3	0	0	3	40	60	100
3.	16CA4303	Software Testing	3	0	0	3	40	60	100
4.	16CA4304	Software Quality Management	3	0	0	3	40	60	100
5.	16CA4305	Cyber Security	3	0	0	3	40	60	100
6.	16BA4352	Accounting and Financial Management	3	0	0	3	40	60	100



**For the students admitted during the academic year 2018-2019 and onwards
SEMESTER V**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CA5201	PHP Programming	3	0	0	3	40	60	100
2	16CA5202	Python Programming	3	0	0	3	40	60	100
3	16CA53XX	Professional Elective III	3	0	0	3	40	60	100
4	16CA53XX	Professional Elective IV	3	0	0	3	40	60	100
5	16CA53XX	Professional Elective V	3	0	0	3	40	60	100
	16CA54XX	Open Elective (Optional)	3	0	0	3	40	60	100
PRACTICAL									
6	16CA5001	PHP Programming Laboratory	0	0	4	2	50	50	100
7	16CA5002	Python Programming Laboratory	0	0	4	2	50	50	100
8	16CA5801	Mini Project	0	0	8	4	50	50	100
Total			15	0	14	23	390	510	800

LIST OF PROFESSIONAL ELECTIVES

ELECTIVE – III RESEARCH ORIENTED									
S.No.	Course	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CA5301	Big Data Analytics	3	0	0	3	40	60	100
2	16CA5302	Data warehousing and Data Mining	3	0	0	3	40	60	100
3	16CA5303	Cloud computing	3	0	0	3	40	60	100
4	16CA5304	Mobile computing	3	0	0	3	40	60	100
5	16CA5305	Semantic Web Services	3	0	0	3	40	60	100
6	16CA5306	Security in computing	3	0	0	3	40	60	100

ELECTIVE – IV & V INDUSTRY ORIENTED									
S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1.	16CA5307	Web Graphics	3	0	0	3	40	60	100
2.	16CA5308	Middleware Technology	3	0	0	3	40	60	100
3.	16CA5309	Management Information Systems	3	0	0	3	40	60	100



4.	16CA5310	E-Commerce	3	0	0	3	40	60	100
5.	16CA5311	Professional Ethics	3	0	0	3	40	60	100
6.	16BA5353	Human Resource Management	3	0	0	3	40	60	100

OPEN ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16CAX4XX	Network Security	3	0	0	3	40	60	100
2	16CAX4XX	Fundamentals of Cloud Computing	3	0	0	3	40	60	100

SEMESTER VI

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROJECT									
1	16CA6901	Project Work	0	0	24	12	100	100	200
Total			0	0	24	12	100	100	200

CREDIT DISTRIBUTION

R2020

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

R2016

Semester	I	II	III	IV	V	VI	TOTAL
Credits	23	22	22	23	23	12	125

A. S. Jayaraj
Chairman, Board of Studies

**Chairman - BoS
MCA - HICET**

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Dean - Academics

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HICET**

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Principal

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



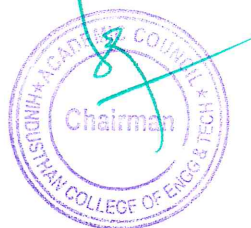
Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1291	PROGRAMMING IN C	3	0	0	0

Unit	Description	Instructional hours
I	Introduction in C- Process of programming – GCD- Programming Cycle – Tracing a Simple Program – Variables	9
II	Operators – Loops – Matrix used Nested Loops – Break statement – Continue Statement	9
III	Data Types in C – ASCII Code - Operators Expressions Associativity - Precedence of operators - Expression evaluation - Functions	9
IV	Arrays in C -Pointers in C -Programming using arrays and pointers -Sizeof operator -Returning pointers from functions – Recursion -Multidimensional Arrays and Pointers	9
V	Structures in C -Singly Linked Lists - Doubly Linked Lists - introduction - Organizing code into multiple files - Pre and post increment - File Handling	9
Total Instructional hours		45

Reference:

R1. NPTEL- Introduction to Programming in [Chttps://onlinecourses.nptel.ac.in/noc19_cs42/preview](https://onlinecourses.nptel.ac.in/noc19_cs42/preview)

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1292	PROBLEM SOLVING AND PROGRAMMING	3	0	0	0

Unit	Description	Instructional hours
	INTRODUCTION TO COMPONENTS OF COMPUTER SYSTEM	
I	Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program	9
	ALGORITHMS & FLOWCHART	
II	Introduction – The Problem-Solving aspect – Top-down Design - steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples.	9
	FUNDAMENTAL ALGORITHMS	
III	Introduction – Exchanging the values – Counting – Factorial Computation – SINE computation – Base Conversion Generation of Fibonacci Sequence	9
	FACTORING METHODS & ARRAY TECHNIQUES	
IV	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	9
	SORTING AND SEARCHING	
V	Two-way Merge – Sorting by Selection – Sorting by Exchange – Sorting by Insertion – Sorting by Diminishing Increment – Binary Search – Hash Searching	9
	Total Instructional hours	45

Reference:

R2. R.GeoffDromey, 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	20CA1091	C PROGRAMMING LAB	0	0	3	0

S.no	Description of the experiments	practical hours
1.	Write a C program to check whether a number is even or odd	6
2.	Write a C Program to Check Leap Year	6
3.	Write a C Program to Find Factorial of a Number	3
4.	Write a C Program to Check Whether a Number is Palindrome or Not	6
5.	Write a C Program to Make a Simple Calculator Using switch...case	3
6.	C Program to Display Fibonacci Sequence	3
7.	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
8.	Write a program to search a given element in array using linear search.	6
9.	To find the smallest and largest element from a given array	3
10.	To Sort n numbers using bubble sort using function sub program	6
Total Instructional hours		45


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SEMESTER I – REGULAR COURSE

SYLLABUS

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.

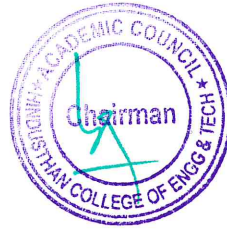
TEXT BOOKS:

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.


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Prograamme	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	<p>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</p>	12
II	<p>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</p>	12
III	<p>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</p>	12
IV	<p>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.</p>	12
V	<p>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</p>	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, Brent Ware, "Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP" Addison Wesley, Pearson 2009
- R4. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010
- R5. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
- R6. Thomas A Powell, "Ajax: The Complete Reference", McGraw Hill, 2008


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

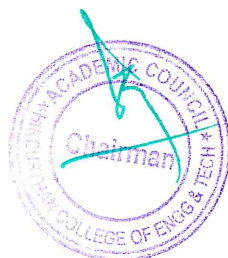
COURSE OUTCOME

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”, Ninth 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


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1203	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
	ESSENTIAL JAVA	
I	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
	OOPS, APPLETS, EXCEPTION HANDLING	
II	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
	EVENT HANDLING WITH SWING	
III	Swing: Swing-Working with Swing –Swing Applet- Swing Application- Swing components- -Layout Managers	12
	I/O HANDLING, MULTI THREADS, DATABASE	
IV	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
	RMI, Servlet	
V	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- Interface 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 looping's.
 - 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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1204	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- McGraw Hill Education, 3rd Edition, 2003.(Units 1,2,3)
 R3. Shio Kumar Singh, Database Systems- Concepts, Designs and Application-Pearson Education, Second Edition, 2013. (Units 4,5).

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	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 program.
 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	<p>OBJECTS, CLASSES AND COMMAND LINE ARGUMENTS</p> <p>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 = $\frac{1}{3}\pi r^2 h$, Area = $\pi r \times \text{slant height}$. 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.</p>	3
2	<p>ATTRIBUTES, METHODS, DATE AND ARRAY OF OBJECTS</p> <p>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.</p> <p>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.</p>	3
3	<p>INHERITANCES</p> <p>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.</p>	3
4	<p>INTERFACE AND PACKAGE</p> <p>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).</p> <p>ii) Create a simple Book class that is contained within a package called backpack. Use import to bring the backpack package into view so that the Book class can be used. Create array of objects for the Book class to get the input.</p>	3
5	<p>WINDOWS, APPLETS AND GRAPHICS</p> <p>i)Font and FontMetric class: Using Frame, display one line of text which has three different types of fonts.</p> <p>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.</p> <p>iii)Applet: Using Applet, display one line of text which has three different types of font.</p> <p>iv)Graphics: Write a java program to draw the figure of a lamp.</p>	6
6	<p>EXCEPTION HANDLING</p> <p>i) Demonstrate ArithmeticException, ArrayIndexOutOfBoundsException, Multiple Catch Clauses, catching subclass Exception, Nested try, throwing an exception, finally, throws.</p>	3

	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.	
	EVENT HANDLING WITH SWING	
7	i) Create a GUI form for a customer in car show room to input/select the car model and other specifications and display the details read. Utilize maximum possible swing components to demonstrate event handling.	3
	ii) Adapter Class: Using the Adapter class MouseAdapter, execute mousePressed and mouseReleased events.	
	I/O	
8	Write a program that copies a text file. The names of the source and destination files are specified on the command line.	3
	MULTITHREADING	
9	i) Create a main thread that can spawn three child threads.	6
	ii) Demonstrate synchronization by controlling access to a method sumArray() which sums the elements of an integer array for 2 child threads.	
	DATABASE	
10	Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so.	3
	RMI	
11	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
	SERVLET	
12	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.


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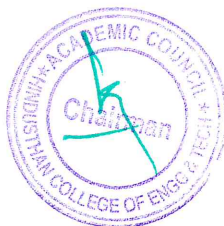
Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1002	DBMS LAB	0	0	3	1.5

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

S.no	Description of the experiments	practical hours
1	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.

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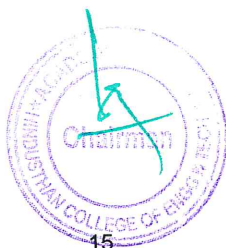
Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA1171	COMMUNICATION SKILL FOR BUSINESS ENGLISH	0	0	4	2

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

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

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

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EVEN SEM
SEMESTER II - BRIDGE COURSE

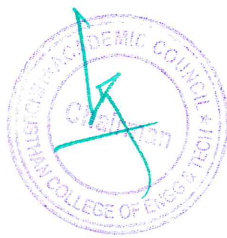
Programme MCA	Course Code 20CA2291	Name of the Course OBJECT ORIENTED PROGRAMMING	L 3	T 0	P 0	C 0
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Unit	Description	Instructional hours
I	Evolution of OOP Languages – Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings – Sorting and Searching – Stack and its Applications - Constants and Inline Functions	9
II	Reference and Pointer - Default Parameters and Function Overloading -Operator Overloading - Dynamic Memory Management	9
III	Classes and Objects -Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator	9
IV	Constness - Static Members - friend Function and friend Class - Overloading Operator for User Defined Types-Namespace -Inheritance	9
V	Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions –Template -Closing Comments	9
Total Instructional hours		45

Reference:

R1. NPTEL – Programming in C++ <https://nptel.ac.in/courses>


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2292	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	0

COURSE OBJECTIVE

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
DIGITAL FUNDAMENTALS		
I	Number Systems and Conversions – Boolean Algebra and Simplification – Minimization of Boolean Functions – Karnaugh Map, Logic Gates – NAND – NOR Implementation.	8
COMBINATIONAL AND SEQUENTIAL CIRCUITS		
II	Design of Combinational Circuits – Adder / Subtractor – Encoder – Decoder – MUX / DEMUX – Comparators, Flip Flop – Triggering – State Diagram and Minimization – Counters – Registers.	10
BASIC STRUCTURE OF COMPUTERS & PARALLEL PROCESSING		
III	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
PROCESSOR DESIGN		
IV	Processor basics – CPU Organization – Data path design – Control design – Basic concepts – Hard wired control – Micro programmed control – Pipeline control – Hazards – super scalar operation	9
MEMORY, I/O SYSTEM AND PARALLEL PROCESSING		
V	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

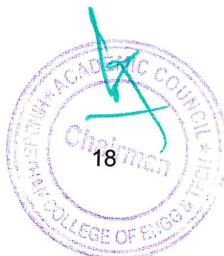
COURSE OUTCOME

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, ZyonkoVranesic, SafwatZakyand NaraigManjikian, " 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.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2091	OBJECT ORIENTED PROGRAMMING LAB	0	0	3	0

S.no	Description of the experiments	Practical hours
1.	Write a C++ program to perform String Concatenation <ul style="list-style-type: none"> • using Arrays • Using Functions • Using Arrays & functions • Using Pointers & Functions 	9
2.	Write a C++ Program to illustrate Enumeration and Function Overloading	3
3.	Implementation of ADT such as Stack and Queues	6
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	6
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	6
Total Instructional hours		45

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SEMESTER II – REGULAR COURSE

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 trees and Graphs.
4. To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
5. To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements.

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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2202	SOFTWARE ENGINEERING	3	0	0	3

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

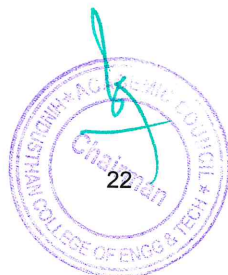
Unit	Description	Instructional Hours
INTRODUCTION		
I	Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model –fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis andmanagement – Requirements and Specification.	9
SOFTWARE DESIGN		
II	Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Conceptsand notations – Real time and Distributed System Design – Documentation – Dataflow Orienteddesign – Jackson System development – Designing for reuse – Programming standards	9
SOFTWARE TESTING AND MAINTENANCE		
III	Software Testing Fundamentals – Software testing strategies – Black Box Testing – White BoxTesting – System Testing – Object Orientation Testing – State based Testing - Testing Tools – TestCase Management – Software Maintenance Organization – Maintenance Report – Types ofMaintenance	9
SOFTWARE METRICS		
IV	Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirectmeasures – Cost Estimation - Reliability – Software Quality Assurance – Standards	9
SCM & WEB ENGINEERING		
V	Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – CASERepository – Features –Web Engineering	9
Total Instructional hours		45

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

REFERENCE BOOKS:

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.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2203	PYTHON PROGRAMMING	3	1	0	4

- 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 Information Visualization and various plotting tools.
 4. To Perform Exploratory Data Analysis, Data Preparation and Preprocessing
 5. To Perform Training and Testing & Implementation of Model

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

- COURSE OUTCOME**
- CO1: Understand the basic concepts of Python Fundamentals.
CO2: Design applications using Functions, Files, Modules, Classes and Objects & Regular Expressions.
CO3: To Implement Data Visualization using various Plotting Tools.
CO4: To Implement Exploratory Data Analysis , Data Preparation and Preprocessing
CO5: To Implement Testing and Training Data set and Model Implementation.

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, PacktPublishing, 2015
R4 - Jake VanderPlas, Python Data Science Handbook, Essential Tools for Working with Data, O'Reilly Media, Inc., 2017

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2204	DATA SCIENCE WITH PYTHON PROGRAMMING	3	1	0	4

Course Objective	
	1. Understand the fundamental concepts of data science
	2. Understand the theoretical properties of methods involved in Data Science.
	3. knowledge of statistical data analysis techniques
	4. Understand various machine learning algorithms used in data science process
	5. Use concepts and methods of mathematical disciplines relevant to data Science

Unit	Description	Instructional hours
I	DATA SCIENCE DS Introduction - DS What is Data - DS DataBase Table - Ds Python - DS Data Frame - DS Functions - DS DataPreparation	12
II	DS MATH DS Linear Functions - DS Plotting Functions - DS Slop & Intercept	12
III	DS STATISTICS Stat Introduction - Stat Percentiles - Stat Deviation - Stat Variance - Stat Correlation - Stat Correlation Matrix - Stat Correlation VS Casuality	12
IV	DS COMPONENTS DS Statistics - DS Visualization - DS Machine Learning - DS Deep Learning	12
V	DS ADVANCED DS Linear Regression - DS Regression Table - DS Regression Info - DS Regression coefficients - DS Regression P-Value - DS Regression R-Squared - DS Linear Regression Case	12
Total Instructional hours		60

Course Outcome	
	CO1: Acquire fundamental concepts of data science.
	CO2: Able to Understand the theoretical properties of methods involved in Data Science.
	CO3: Apply the acquired knowledge of statistical data analysis techniques
	CO4: Apply the acquired knowledge of machine learning algorithms used in data science process
	CO5: Apply the concepts and methods of mathematical disciplines relevant in Data Science

REFERENCE BOOKS:

- R1. Machine Learning for Absolute Beginners, January 1, 2018, Scatterplus.com, Oliver Theobald
- R2. Introduction to Statistics, Jim Frost, Jim Publishing, 2018
- R3. William McKinney Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly Media, Inc., 2017
- R4. ManasaKalaimalai, The Essential Beginner's Guide to Data Science, Notion Press,2020.

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

S.no	Description of the experiments	practical hours
1,2	<p>Develop programs to understand the control structures of python</p> <ol style="list-style-type: none"> 1. X, a currency conversion agent, serves his customers in exchanging currencies from Indian rupee to US Dollar. Write a program to automate the process of finding the equivalent amount in US Dollar. (Assume that the US Dollar equivalent for Indian one rupee is also given as input) 2. Being a student of Hindusthan, Ram wants to calculate the GPA (Grade Point Average), which is calculated using the formula, Sum of all marks multiplied by its corresponding credits / total credits. Assume that the student has three subjects in the semester. Write a program to automate the calculation process. 	3
3	<p>Develop programs to learn different types of structures (list, dictionary, tuples) in python</p> <p>Mohan has got lot of friends all around the world. All of them have the interesting habit of sending letters to each other to express their feelings. Mohan has the practice of keeping all the stamps pasted on the letters safely. On every New Year Day, he arranges all the stamps of preceding year according to the month of arrival, puts it on a small cover (stamps of four months are put in same cover) and indexes it with numbers. For example, 1 to represent January to April, 2 to represent May to august etc.. Along with the index, the number of stamps for those months is also stored. He then puts everything in a big cover and labels it with year number. At the age of 35, he has got around 3 such covers labeled with years of arrival. Mohan's cute son wants to see how many stamps he has collected in August '2007. Help him to find out by writing a python code. (Assume that the covers are not in sequence).</p>	6
4	<p>Strings & Functions</p> <p>The details of all employees (ID no, name, mobile number) of a company XYZ is stored and maintained by the company's IT department. On his birthday, the GM of the company wants to surprise a few of his employees with experience more than five years and whose ID number is divisible by 5 by giving Rs.5000. He instructs the IT department to display the mobile number along with the name of all employees who are eligible for gift. Write a program to automate the selection and intimation. Name of a person is in the form initial (One letter), dot and any number of alphabets, spaces. Check the validity of the name entered and validity of the mobile number. A valid mobile number must consist of 10 digits and the first digit must not be zero. Print 'Invalid input' when conditions are not satisfied and break the process of getting input. Use functions.</p>	6
5,6	<p>Regular Expressions & Packages</p> <ol style="list-style-type: none"> 5. Mr. X as part of his online typing job, like to extract the email ids for his reference. The email ids are supposed to be in the following formats, <u>username@company.com</u> or <u>username@company.ac.in</u> . Additionally, the email ids may end with org or net instead of com. Help Mr. X by writing a Python code to retrieve the code. 6. Automatic toll collection centers scan the vehicle's number plate and check whether the vehicle belongs to Tamilnadu (TN) or Kerala (KL). The structure of a vehicle number is as follows: Two alphabets indicating the state, followed by two numbers representing the code of registration centre. This is followed by two alphabets and two numbers representing the sequence of registrations. Example: TN12 AL1143 is a valid no whereas TN12 A123 is not valid. Write a Python program to check whether the vehicle number scanned is valid and hence check whether the 	6

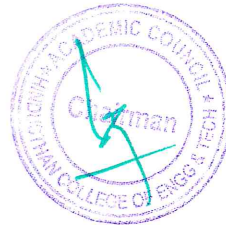
	vehicle belongs to TN or KL.																																																													
7	<p>Exception Handling</p> <p>Online shopping website 'X' sells many interesting items by showing the catalogs. The users can give the item code (a six character string with three alphabets followed by three digits), quantity required (number) and the color (string) required. Write a program using Python that prompts the user all these details and displays the total amount to be paid inclusive of shipping fee Rs.50/-. (Assume cost of each individual item). All inputs are to be validated based on given condition and exceptions to be thrown accordingly.</p>	3																																																												
8	<p>Object Oriented Programming in Python</p> <p>User convenience becomes the mandatory reason for updates in any industry. Mobile phone industry is fast growing with updated functionalities for every new model. For eg., Earlier model of mobile phones has the provision to store only first name whereas recent mobile phones come with the provision to add firstname, middlename and lastname. But it's a condition that all mobile phone models should have the provision to store atleast first name.</p> <p>The software for managing user interface should possess the capability to support all the mobile phone models. Assuming that the user interface for mobile phones is designed using JAVA, write a program that can store and display the names in the below format depending upon the input from the user.</p> <p>For eg., if the input is "Wolfgang", then the output will be Wolgnagf.</p> <p>If the input has three strings i.e., Wolfgang, Amadeus, and Mozart, then the output should be WolsuedamAMozart.</p>	3																																																												
9	<p>Visualization – Qualitative and Quantitative Analysis</p> <p>Design and plot an informative chart(s) for visualizing the comparison between region-wise sales, region-wise profit and region-wise discount of super-store dataset. The plot should have a minimum of five numerical information for better understanding of data. Dataset may be downloaded from https://www.kaggle.com/juhi1994/superstore</p>	6																																																												
10	<p>Numpy and Pandas</p> <ol style="list-style-type: none"> Download pokeman dataset from https://www.kaggle.com/rounakbanik/pokemon and load it in a dataframe. Check for the details of columns and analyse by printing the details of data. Check for missing values and if present fill those with the median of each feature. Find out the presence of outliers and remove them if present in the data. Use boxplot for visualizing the range of values present in the features. Visualize the correlation between the various features of the dataset. Remove the columns with minimum relationship between each other. Use swarmplot for visualization. 	6																																																												
11	<p>Model Implementation</p> <p>A sample dataset about the various crimes is given below. Develop a suitable model with appropriate machine learning algorithm for a meaningful inference using Python. Justify your selection.</p> <table border="1"> <thead> <tr> <th>Person</th> <th>Murder</th> <th>Assault</th> <th>Urban Pop</th> <th>Theft</th> </tr> </thead> <tbody> <tr><td>P1</td><td>13.2</td><td>236</td><td>58</td><td>21.2</td></tr> <tr><td>P2</td><td>10.0</td><td>263</td><td>48</td><td>44.5</td></tr> <tr><td>P3</td><td>8.1</td><td>294</td><td>80</td><td>31.0</td></tr> <tr><td>P4</td><td>8.8</td><td>190</td><td>50</td><td>19.5</td></tr> <tr><td>P5</td><td>9.0</td><td>276</td><td>91</td><td>40.6</td></tr> <tr><td>P6</td><td>7.9</td><td>204</td><td>78</td><td>38.7</td></tr> <tr><td>P7</td><td>3.3</td><td>110</td><td>77</td><td>11.1</td></tr> <tr><td>P8</td><td>5.9</td><td>238</td><td>72</td><td>15.8</td></tr> <tr><td>P9</td><td>15.4</td><td>335</td><td>80</td><td>31.9</td></tr> <tr><td>P10</td><td>17.4</td><td>211</td><td>60</td><td>25.8</td></tr> <tr><td>P11</td><td>5.3</td><td>46</td><td>83</td><td>20.2</td></tr> </tbody> </table>	Person	Murder	Assault	Urban Pop	Theft	P1	13.2	236	58	21.2	P2	10.0	263	48	44.5	P3	8.1	294	80	31.0	P4	8.8	190	50	19.5	P5	9.0	276	91	40.6	P6	7.9	204	78	38.7	P7	3.3	110	77	11.1	P8	5.9	238	72	15.8	P9	15.4	335	80	31.9	P10	17.4	211	60	25.8	P11	5.3	46	83	20.2	6
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	P12	2.6	120	54	14.2			
	P13	10.4	249	83	24.0			
	P14	7.2	113	65	21.0			
	P15	2.2	56	57	11.3			
	Total Instructional hours							45

COURSE
OUTCOME

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

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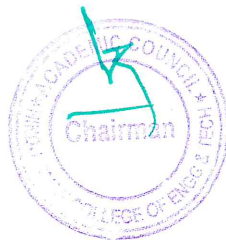
Programme	Course Code	Name of the Course	L	T	P	C
MCA	20CA2002	DATA STRUCTURE AND ALGORITHMS LAB	0	0	3	1.5

- 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.

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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16BA3251	ORGANIZATIONAL BEHAVIOUR	3	0	0	3
Course	1. To understand the focus, purpose and importance of organizational behaviour.					
Objective	2. To understand the various aspects related to individuals behaviour in an organization.					
	3. To comprehend the formation of organization structure and the influence and role of Groups in organisation					
	4. To expose the students to various leadership styles and the influence of Power and politics in organization.					
	5. To know the dynamics of organizational behaviour.					

Unit	Description	Instructional Hours
	FOCUS AND PURPOSE	
I	Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.	5
	INDIVIDUAL BEHAVIOUR	
	Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification. Misbehaviour –	
II	Types – Management Intervention. Emotions - Emotional Labour – Emotional Intelligence – Theories. Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. Motivation – importance – Types – Effects on work behavior.	12
	GROUP BEHAVIOUR	
III	Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building - Interpersonal relations – Communication – Control.	10
	LEADERSHIP AND POWER	
IV	Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.	8
	DYNAMICS OF ORGANIZATIONAL BEHAVIOUR	
	Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives – Organizational effectiveness	10
Total Instructional Hours		45

Course Outcome	CO1: Students will be familiar with the features and importance of organizational behaviour.
	CO2: Can recognize aspects like personality, learning, emotions, attitudes, perceptions, motivation etc which will affect individual's behaviour in an organization.
	CO3: Enables to understand and handle group behaviour effectively.
	CO4: Gives an understanding on various leadership styles and the influence of Power and Politics in organization.
	CO5: Ensures to have a better understanding on the dynamics of organizational behaviour.

REFERENCE BOOKS:

- R1 - Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 15th edition, 2013.
- R2 - Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2011.
- R3 - Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley, 9th Edition, 2011.
- R4 - UdaiPareek, Understanding Organisational Behaviour, 2nd Edition, Oxford Higher Education, 2013.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA3201	COMPUTER NETWORKS	3	0	0	3

Course Objective
 To understand networking concepts and basic communication model
 To understand network architectures and components required for data communication.
 To analyze the function and design strategy of physical, data link, network layer and transport layer
 To acquire knowledge of various application protocol standard developed for Internet
 To understand various security algorithms over application layer

Unit	Description	Instructional Hours
	NETWORK FUNDAMENTALS	
I	Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology - Transmission media	9
	DATA LINK LAYER	
II	Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth - Bridges.	9
	NETWORK LAYER	
III	Network layer – Switching concepts – Circuit switching – Packet switching –IP – Data grams – IP addresses- IPV6– ICMP – IGMP - Routing Protocols – Distance Vector – Link State- BGP.	9
	TRANSPORT LAYER	
IV	Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. -Transport for Real Time Applications (RTP).	9
	APPLICATION LAYER	
V	Applications – DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA- web security –SSL	9
	Total Instructional Hours	45

Course Outcome
 CO1: Understand the basic concepts in computer networking.
 CO2: Apply the functions of different layers and in depth knowledge of datalink layer.
 CO3: Analyze the different protocols and network layer components.
 CO4: Identify the basic functions of transport layer and congestion in networks.
 CO5: Explain the working of application layer.

REFERENCE BOOKS :

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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA3202	COMPILER DESIGN AND ANALYSIS	3	0	0	3

- COURSE OBJECTIVE**
- To introduce the major concept areas of language translation and compiler design.
 - To enrich the knowledge in various phases of compiler and its use
 - To extend the knowledge of parser
 - To develop an awareness on code optimization techniques, machine code generation
 - To provide practical programming skills necessary for constructing a compiler

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Language Processors – Structure of a compiler -The phases of a compiler- Cousins of the compiler-The grouping of phases-Compiler-construction tools. Simple syntax-directed translation : Introduction -Syntax definition-Syntax-directed translation-Parsing –A translator for simple expressions-Lexical analysis.	9
	LEXICAL ANALYSIS	
II	The role of the lexical analyzer-Input buffering-Specification of tokens-Recognition of tokens-A language for specifying lexical analyzers-Finite automata-From a regular expression to an NFA-Design of a lexical analyzer generator-Optimization of DFA - based pattern matchers.	9
	SYNTAX ANALYSIS	
III	Introduction: The role of the parser-Context-free grammars-Writing grammar-Top down parsing-Bottom-up parsing-Operator-precedence parsing-LR parsers-Using ambiguous grammars-Parser generators.	9
	INTERMEDIATE CODE GENERATION	
IV	Variants of Syntax Tree – Three Address Code – Types and Declarations – Type checking – Rules of type checking – Type Conversion – Control Flow – Back patching	9
	CODE GENERATION	
V	Issues in the Design of a Code Generator – The Target Language – Addresses in the Target Code – Basic Blocks and Flow Graphs – Optimization of Basic Blocks - A Simple Code Generator – DAG Representation of Basic Blocks – Peephole Optimization – Code Generation from DAG- Register Allocation and Assignment	9
	Total Instructional Hours	45

- Course Outcome**
- CO1: To Acquire the knowledge of compiler & its features
CO2: To Understand the role of a lexical analyzer and identify and design top down and bottom up Parsing techniques
CO3: To Construct a syntax tree and generate three address codes
CO4: To Compare flow graphs and basic blocks and write efficient codes using peephole optimization
CO5: To Implement various optimization and code generation algorithms for the design of a compiler

REFERENCE BOOKS :

- R1 - Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, —Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education,2013.
R2 - Allen I. Holub, “Compiler Design in C”, Prentice-Hall software series, 2012
R3 - Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence based Approach”, Morgan Kaufmann Publishers, 2012
R4 - Steven S. Muchnick, “Advanced Compiler Design and Implementation”, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2013.
R5 - Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Morgan Kaufmann Publishers Elsevier Science, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA3203	JAVA PROGRAMMING	3	0	0	3

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

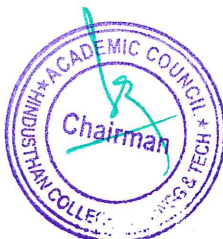
Unit	Description	Instructional Hours
	INTRODUCTION	
I	Java Features – The Byte Code – Lexical issues - Class Fundamentals – Objects – Overloading Methods – Passing and returning objects – Recursion – Controlling access to members – this keyword - static and final keyword..	9
	INHERITANCE & PACKAGES	
II	Nested classes – Inheritance – Using super keyword – Multi Level hierarchy – Method Overriding - Dynamic Method Dispatch – The Object class – Abstract classes - Packages – Access modifiers – Importing packages – Interfaces – Applying interfaces.	9
	EXCEPTION HANDLING & THREADS	
III	Exception handling – Using try catch – Nested try- throw – throws – finally – Built in exceptions – user defined exceptions - Chained exceptions; Threads – Thread model – Creating a thread – Thread priorities – Synchronization – Multithreading – Suspending, resuming and stopping threads.	9
	FRAMES & APPLETS	
IV	Java Frame – basic GUI components – Delegation event model - Event Classes– Source of events – Event Listener Interface – Applet Programming.	9
	FILES & DATABASES	
V	I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Case Study on System class and Utility classes.	9
	Total Instructional Hours	45

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

REFERENCE BOOKS:

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

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA3204	COMPUTER GRAPHICS AND MULTIMEDIA	3	0	0	3

- Course Objective
1. Understand the fundamentals of graphics and multimedia.
 2. Gain knowledge in the concepts of 2D and 3D graphics programming.
 3. Acquire skills related to multimedia compression and animation
 4. Formulate a working definition of interactive multimedia;
 5. provides an idea of multimedia authoring and presentations

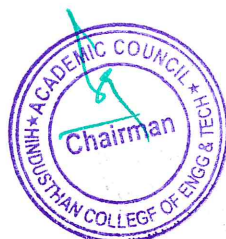
Unit	Description	Instructional Hours
	2D PRIMITIVES	
I	Output primitives- Line drawing , Circle drawing and Ellipse drawing algorithms - Attributes of output primitives - Two dimensional Geometric transformations – Basic Transformation – Matrix representations – Composite transformations – Other transformations - Two dimensional viewing - Cohen-Sutherland Line Clipping, Sutherland Hodgeman Polygon clipping algorithms	9
	3D CONCEPTS	
II	Parallel and Perspective projections - Three dimensional object representation - Polygon, Curved lines, Quadric surfaces – Spline Representations - 3D transformations - Viewing – Projections -Visible surface Identification – Classification of Visible Surface Detection Algorithms – Back face detection – Depth Buffer Method – A Buffer Method.	9
	COLOR MODELS AND COLOR APPLICATIONS	
III	Color Models - RGB, YIQ, CMY, HSV - Animations - General Computer Animation, Raster, Key frame .	9
	MULTIMEDIA BASICS	
IV	Introduction and definitions – Multimedia Authoring Systems – Multimedia Authoring – Editing and Authoring tools – VRML – Graphics and Image Representation	9
	MULTIMEDIA SYSTEMS	
V	Compression -Types of Compressions: Lossless - Lossy - Video compression - Image Compression standards – JPEG standard –JPEG 2000 –JPEG LS standard	9
	Total Instructional Hours	45

- Course Outcome
- CO1: Demonstrate 2D transformation using 2D primitives.
CO2: Implement 3D projections and transformations.
CO3: Identify the different color models.
CO4: Understand the basics of multimedia.
CO5: Illustrate the multimedia authoring systems and compression types

REFERENCE BOOKS

- R1 - Donald Hearn, M.Pauline Baker, Computer Graphics C Version, Pearson Education, 2011.
R2 - Ze-Nian Li and Mark S.Drew, Fundamentals of Multimedia, PHI Learning, 2008
R3 - F.S.Hill, Computer Graphics using OPENGL, 2nd edition, Pearson Education, 2009
R4 - Prabhat K Andleigh, KiranThakrar, Multimedia systems design, 1st Edition, PHI, 2009

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Programme	Course Code	Name Of The Course	L	T	P	C
MCA	16CA3001	SOFTWARE ENGINEERING TOOLS LABORATORY	0	0	4	2

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

S.No	Description Of The Experiments
1	Practicing the different types of case tools such as (Rational Rose & other Open Source) used for all the phases of Software development life cycle.
2	Implementation of the Data modeling using CASE Workbenches and develop online railway reservation system.
3	Implementation of the Data modeling using CASE Workbenches for Library management system.
4	Implementation of the Project management using CASE Workbenches and develop Payroll processing application.
5	Implementation of the Source code generators using CASE Workbenches and develop Inventory system
6	Implementation of the Source code generators using CASE Workbenches for Payroll system
7	Implementation of the User-interface development using CASE Workbenches and develop Library management system
8	Implementation of the Programming using CASE Workbenches and Create a dictionary
9	Implementation of the Verification and validation using CASE Workbenches for Payroll system
10	Implementation of the Verification and validation using CASE Workbenches for Library management system

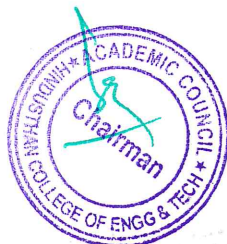
Total Instructional Hours 45

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

Software required:

- **Languages:** C/C++/Java/JSDK/Web browser.
- Any front end tool (like VB, VC++) etc
- **Any backend tool** (Oracle, Ms-Access, SQL) etc.
- **Any CASE tool** (Rational Rose or other Open Source)

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA3002	JAVA PROGRAMMING LABORATORY	0	0	4	2

- Course Objective
1. To impart the basic programming constructs in Java to develop simple object oriented programs
 2. To explore the skills in program development using Exception handling and multi-threading concepts.
 3. To develop applications using I/O Streams
 4. To gain programming skills to establish database connectivity
 5. To gain the built in knowledge of standalone and web applications

Expt. No. Description of the Experiments

1. Create an Employee payroll application using classes, objects and constructors. Create objects for three different employees and calculate HRA, DA and total pay
2. Create a Banking Application to calculate simple interest and compound interest using Abstract class, Packages and Interface.
3. Write a Java program to illustrate Method Overloading to calculate the area of the following shapes (i) Square (ii) Rectangle (iii) Circle
4. Write a Java program to implement multi threading concepts

Write a Java program to illustrate Method Overriding for the following:

5. Get the empid, name, grade, salary, designation from the user. Create a base class employee and display the employee details using show() method. Create a derived class sports employee and display the sports details using show() method.

Write a Java Program to throw a User Defined Exception for the following

6. Credit Point Validation

Age Less Than Twenty

Write a Java program to implement the following in-built exceptions:

7. Array Index Out Of Bounds Exception

Arithmetic Exception

8. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism.

9. Write a window based Graphic User Interface applications using frames and applets to simulate a calculator application. Use Grid Layout to place the components

10. Write a java program to implement different forms of Inheritance for employee information system.

Write a java program with Database Connectivity for the following web based application to check the status of student result.

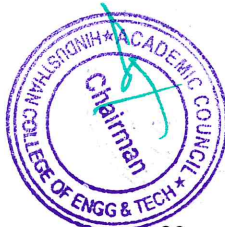
11. Create a Database for student with the following fields: Regno, Name, Mark1, Mark2, Mark3, Mark4, Mark5 and Grade.

Create a HTML for getting Regno from the user.

Create an application program for displaying the student details for the corresponding Regno

Total Practical Hours 45

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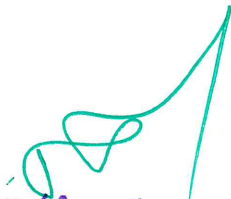
Course Outcome

CO1:Develop programs using OOPS concepts.
CO2: Analyze the various Java packages and understand the way the classes are organized
CO3:Implement programs using Input and Output in Java.
CO4:Execute programs in Applet, AWT and Event handlers in Java.
CO5:Design programs using Database connectivity

Software required:

- Java 2.0, NetBeans 8.0


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Programme	Course Code	Name Of The Course	L	T	P	C
MCA	16CA3003	COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY	0	0	4	2

- Course Objective
1. The objectives of the course are to: Understand the need of developing graphics applications.
 2. Learn the hardware involved in building graphics applications.
 3. Learn algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc.
 4. Learn the representation and transformation of graphical images and pictures.
 5. Learn the concept of Color Generation.

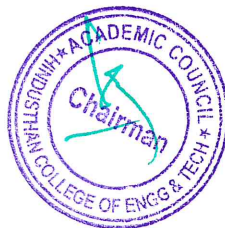
S.No	Description Of The Experiments
1	LINE DRAWING AND CIRCLE DRAWING ALGORITHMS Implement Line drawing algorithm like DDA, Bresenham's Line Drawing, Mid circle drawing
2	TWO DIMENSIONAL TRANSFORMATIONS: Creation of two dimensional objects and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations
3	THREE DIMENSIONAL TRANSFORMATIONS: Creation of simple three dimensional objects like cube, cone and cylinder and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations.
4	IMAGE EDITING: Image enhancement, Image transformation from color to gray scale and vice versa, Image manipulation and Image optimization for web - Usage of editing tools, layers, filters, special effects and color modes.
Total Instructional Hours	
45	

- Course Outcome
- CO1: Understand the basic concepts of computer graphics.
CO2: Apply clipping and filling techniques for modifying an object.
CO3: Understand the concepts of different type of geometric transformation of objects in 2D and 3D.
CO4: Understand the practical implementation of modeling, rendering, viewing of objects in 2D.
CO5: Understand the concepts of Viewing, Curves and surfaces

Software required:

- Turbo C , Adobe PhotoShop 6

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Programme	Course Code	Name Of The Course	L	T	P	C
MCA	16CA3004	CAREER AND SOFT SKILL DEVELOPMENT – I	0	0	2	1

Course Objective

1. To enhance the performance of students in placement, interviews and Group discussion.
2. To understand team dynamics & effectiveness.
3. To learn leadership qualities and practice them.

S.NO	DESCRIPTION OF THE EXPERIMENTS	PRACTICAL HOURS
1	<ol style="list-style-type: none"> 1. Introduction to Communication 2. The Process of Communication. 3. Verbal and Non- Verbal communication. . 4. Barriers of Communication. 5. Dyadic Communication. 	15
2.	<ol style="list-style-type: none"> 1. Listening Process 2. Purpose of Listening 3. Common Barriers to the Listening Process 4. Measures to improve listening skill 5. Intensive Listening and Listening for specific information. 	10
3.	<ol style="list-style-type: none"> 1. Reading and understanding written materials. 2. Techniques of reading, skimming, and Scanning. 3. General Principles of Writing. 4. Writing Memo, circular and Notice. 5. Report Writing. 	10
4.	<ol style="list-style-type: none"> 1. Group Discussion Techniques. 2. Developing body language. 3. Practicing etiquette . 4. Delivering a Presentation. 5. Developing interpersonal relationship. 6. Types of Interviews and Career Planning. 	10
TOTAL INSTRUCTIONAL HOURS		45


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RECORD LAY OUT

1. Every student has to maintain a record in which he / she has to incorporate the following details.
2. Students have to collect materials related to topics for Group Discussion / Debate.
3. 10 assignments of Lab observations related to Presentation Skills about 200 words each.
4. Covering letter with Bio data / Resume / Curriculum Vitae.
5. Paper Presentation Topics with source materials to be pasted in the record.

Course	CO1: Display competence in oral, written, and visual communication.
Outcome	CO2: Show an understanding of opportunities in the field of communication.
	CO3: Demonstrate positive group communication exchanges.
	CO4: Apply appropriate communication skills across settings, purposes, and audiences.
	CO5: Build and maintain healthy and effective relationships.

REFERENCE BOOKS:

- R1 - Interactive Multimedia Programs on Managing Time and Stress.
R2 - Personality Development (CD-ROM), Times Multimedia, Mumbai.
R3 - Robert M Sherfield "Developing Soft Skills" 4th edition, New Delhi: Pearson Education, 2009.

WEB SOURCES:

- W1 - <http://www.kent.ac.uk/careers/cv/coveringletters.htm>
W2 - http://www.mindtools.com/pages/article/newCDV_34.htm


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4201	OPERATIONS RESEARCH	3	1	0	4

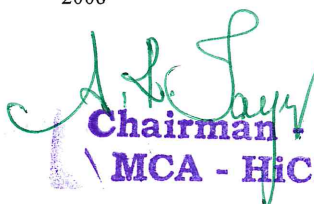
- Course Objective
1. To provide the concept and an understanding of basic concepts in Operations Research Techniques for Analysis and Modeling in Computer Applications.
 2. To understand, develop and solve mathematical model of linear programming problems
 3. To understand, develop and solve mathematical model of Transport and assignment problems
 4. To Understand network modeling for planning and scheduling the project activities
 5. To Understand and differentiate the different queuing models

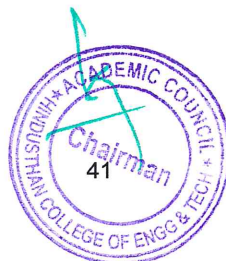
Unit	Description	Instructional Hours
LINEAR PROGRAMMING MODELS		
I	Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex method	12
TRANSPORTATION AND ASSIGNMENT MODELS		
II	Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem	12
INTEGER PROGRAMMING MODELS		
III	Formulation – Gomory’s IPP method – Gomory’s mixed integer method – Branch and bound technique.	12
SCHEDULING BY PERT AND CPM		
IV	Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling	12
QUEUEING MODELS		
V	Characteristics of Queuing Models – Poisson Queues - (M / M / 1) : (FIFO / ∞ / ∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / ∞) models.	12
Total Instructional Hours		60

- Course Outcome
- CO1: Able to understand and apply linear, integer programming to solve operational problem with constraints
- CO2: Able to Apply transportation and assignment models to find optimal solution in warehousing and Travelling.
- CO3: Able to Demonstrate project scheduling using PERT and CPM
- CO4: Able to Identify and analyze appropriate queuing model to reduce the waiting time in queue.
- CO5: Able to Interpret optimization concepts in real world problems

REFERENCE BOOKS:

- R1 - Taha H.A., "Operations Research : An Introduction " 8th Edition, Pearson Education, 2008.
- R2 - A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2014.
- R3 - Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand& Company Ltd, New Delhi, 3rd Edition , 2008.
- R4 - John W. Chinneck "Feasibility and Infeasibility in Optimization Algorithms and Computational Methods" Springer, 2008
- R5 - Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007.
- R6 - Gross, D. and Harris, C.M., "Fundamentals of Queueing Theory", Wiley Student, 3rd Edition, New Jersey, 2008


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Programme	Course code	Name of the course	L	T	P	C
MCA	16CM4321	EMBEDDED SYSTEMS	3	0	0	3

- Course Objective
1. To gain knowledge about how the I/O devices are interfaced with 8051 microcontroller
 2. To Learn Assembly language programming in 8051.
 3. To understand the Basic concepts of 8051 microcontroller and Embedded systems
 4. To understand the basic embedded system design.
 5. To understand various case studies.

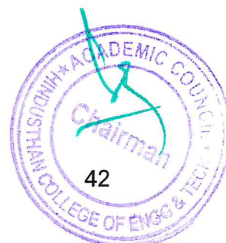
Unit	Description	Instructional Hours
INTRODUCTION TO 8-BIT MICROCONTROLLER		
I	Intel 8051 Architecture- Processor and Memory Organization-Interrupts of 8051 - Addressing Modes - Instruction Set –Memory mapped I/O - I/O mapped I/O- Assembly Language Programming Using 8051	9
INTERFACING WITH 8051		
II	Input- Output Interfacing – Bus Standards – PCI – ISA – Timing And Control – Input Output Devices –Serial And Parallel Communication – Motor Control- Programming Display Devices – ARM Architecture.	9
EMBEDDED SYTEM		
III	Embedded Systems- Processor Embedded Into A System-Embedded Hardware And Software Units- Applications-Design Process-Inter Process Communication – Signal Functions –Mailbox - Pipes –Memory Management Device, Files And I/O Subsystem – Basic Design of RTOS	9
SYSTEM DESIGN TECHNIQUES		
IV	Design methodologies- Design flows - Requirement Analysis – Specifications- System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors	9
CASE STUDY		
V	Automated Teller Machine - Alarm Clock - Audio player – Automatic Chocolate Vending Machine - Digital still camera – Telephone answering machine - Engine control unit – Antilock Braking System.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Able to understand 8051 microcontroller functions
CO2: Able to gain basic knowledge in ARM architecture
CO3: Able to design and control real time control systems
CO4: Acquire the knowledge of embedded system design and implement real time functions
CO5: Able to design embedded system based on case studies

REFERENCES BOOKS:

- R1 - Rajkamal, "Embedded System: Architecture, Programming And Design" Tata Mcgraw-Hill Education, Second Edition, 2008.
R2 - Marilyn Wolf, "Computers As A Components" Third Edition, Morgan Kaufmann Series 2012.
R3 - B.KanthRao, "Embedded Systems" PHI Learning Private Limited, 2011
R4 - Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
R5 - K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4202	NETWORK PROGRAMMING	3	0	0	3

- Course Objective
1. To state the major components and describe the architecture of the LINUX operating system
 2. To use SHELL programming to create simple tools for the information processing
 3. To understand IPC using various techniques and Signal Generation
 4. To understand usage of TCP/UDP / Raw sockets
 5. To explain Socket programming to design client- server environment

Unit	Description	Instructional Hours
	INTRODUCTION TO LINUX & SHELL	
I	Introduction to Linux - Basic commands and file handling commands, Standard I/O, pipes and standard error related commands, Task Control commands UNIX Shell Scripting Introduction - Loop control, Arrays and Arithmetic, Case, Co-routines, practicing sample shell scripts	9
	IPC & SIGNALS	
II	Process control – Process relationships - Signals generation and handling, signal functions – Interprocess Communication using PIPE, FIFO, MESSAGE QUEUE, SHARED MEMORY, SEMAPHORES	9
	ELEMENTARY TCP SOCKETS	
III	Introduction to Socket Programming –Introduction to Sockets – Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions –Concurrent Server. TCP Echo Server – TCP Echo Client	9
	ELEMENTARY UDP SOCKETS	
IV	Elementary UDP sockets – UDP echo Server – UDP echo Client- Domain name system – gethostbyname function – gethostbyadr function –getservbyname and getservbyport functions	9
	ADVANCED SOCKETS	
V	Threaded servers – thread creation and termination – TCP echo server using threads – Mutexes – condition variables – raw sockets – ping program – trace route program	9
Total Instructional Hours		45

- Course Outcome
- CO1 :Understanding the basics of Linux Environment and Code programs on Shell Scripts
CO2 :Demonstrate Signal Handling mechanism and implement programs using various IPC techniques
CO3: Design and implement client-server applications using Elementary TCP Sockets & UDP Sockets
CO4: Understanding DNS and implement its various functions.
CO5: Design and Implement applications using Multithreading and Advanced Socket programming

REFERENCE BOOKS:

- R1 - W. Richard Stevens, B. Fenner, A.M. Rudoff, "Unix Network Programming – The Sockets Networking API", 3rd edition, Pearson, 2009
R2 - W. Richard Stevens, S.A Rago, "Advanced Programming in the Unix environment", 2nd edition, Pearson, 2013
R3 –B.M.Harwani, Unix and Shell programming, Oxford University Press, 2013
R4 - Matthew, Neil and Richard Stones, "Beginning Linux Programming". John Wiley and Sons, 2011


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Programme	Course code	Name of the course	L	T	P	C
MCA	16CM4001	EMBEDDED SYSTEMS LABORATORY	0	0	4	2

- Course Objective
1. Demonstrate the 8051 and ARM kit ,instruction set & write Assembly Language program
 2. Apply the programming concepts to 8051 and ARM Microcontroller
 3. Use proper peripheral devices and interface to 8051
 4. Formulate the concept of mail box in RTOS.
 5. Demonstrate ARM based interfacing

S.No Description Of The Experiments

8051 Experiments using kits

- 1 Basic arithmetic and Logical operations
- 2 Square & Cube of a number
- 3 Matrix Addition and Subtraction
- 4 Sorting, Largest & Smallest of an array
- 5 1's and 2's complement of a number
- 6 Stepper motor control interface

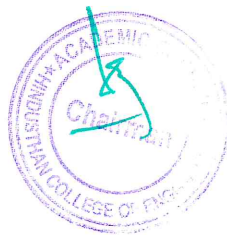
ARM Experiments using kits

- 7 Blinking of LED's connected through PORTS
- 8 Relay control
- 9 Interfacing PWM and LED
- 10 Mailbox

Total Instructional Hours 45

- Course Outcome
- CO1: Analyze the performance of 8051 programs for various types of inputs.
CO2: Formulate the design logic of ARM programs
CO3: Develop one industrial application using peripheral devices
CO4: Interface various modules with 8051 and ARM
CO5: Develop mailbox and enable intra process communication using RTOS

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Programme	Course code	Name of the course	L	T	P	C
MCA	16CA4002	NETWORK PROGRAMMING LABORATORY	0	0	4	2

- Course Objective
1. To Understand the Basic Linux Commands and to implement simple programs in Shell Scripts.
 2. To understand IPC using various techniques and Signal Generation
 3. To understand the use of client/server architecture in application development using TCP ,UDP and Raw Sockets
 4. To Understand the Concept of Domain Name System
 5. To achieve the concept of synchronization using various techniques

S.No	Description of the Experiments	Total Practical Hours
1	Implementation of Basic Linux Commands, I/O redirection & Pipes and Task Control	
2	Implementation of Basic Shell Scripts	
3	Implementation of Connection oriented service using TCP	
4	Implementation of Connectionless Oriented Service using UDP	
5	Implementation of IPC using PIPE, FIFO, SHARED MEMORY, MESSAGE QUEUE	
6	To illustrate the concept of interrupt signal using signal handler and division by zero using sigaction.	
7	Implement Domain name System using its various Functions	
8	To implement multiple client chatting with a single server	
9	Implement a program for producer and consumer problem to achieve synchronization using semaphores	
10	Implement producer consumer problem using mutex and conditional variables	
11	To implement a trace route program given an IP address.	
12	Implement a Ping program in C	
Total Instructional Hours		45


- Course Outcome
- CO1 :Understanding the basics of Linux Environment and Code programs on Shell Scripts
CO2 :Demonstrate Signal Handling mechanism and implement various IPC techniques
CO3: To design and implement client-server applications using Connection oriented and Connectionless methods
CO4: Construct various functions of DNS.
CO5: Design and Implement applications to achieve Synchronization using semaphores and Mutex and code Ping and Trace route using Raw Sockets.

Software required:

- C with Unix
- Telnet


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Programme	Course Code	Name Of The Course	L	T	P	C
MCA	16CA4003	CAREER AND SOFT SKILL DEVELOPMENT - II	0	0	2	1

S.No	Description of The Experiments	Practical Hours
1	1. Vocabulary skill. 2. Common Errors in Speaking. 3. Making of Sentences. 4. Writing formal letters. 5. Real Life conversations. 6. Stress and Intonation.	15
2.	1. Positive Attitude & Self Confidence 2. Motivation Skills & Personality Development. 3. Goal Setting. 4. Career Planning. 5. Presentation Skills.	10
3.	1. Interview skills. 2. Debate. 3. Effective use of body language. 4. Group Dynamics 5. Managing Team Performance & Team Conflicts	10
4.	1. Time Management 2. Problem Solving Skill 3. Report Writing 4. E-Mail Writing. 5. Note Making	10
INSTRUCTIONAL HOURS		45

RECORD LAY OUT

- Every student has to maintain a record in which he / she have to incorporate the following details.
- Students have to collect materials related to topics for Group Discussion / Debate.
- 10 assignments of Lab observations related to Presentation Skills about 200 words each.
- Covering letter with Bio data / Resume / Curriculum Vitae.
- Paper Presentation Topics with source materials to be pasted in the record.

CO1: Display competence in oral, written, and visual communication.
 CO2: Handle Engineering Ethics and Human Values.

COURSE OUTCOME

CO3: Make effective presentations.
 CO4: Show an understanding of opportunities in the field of communication.
 CO5: Communicate ethically.

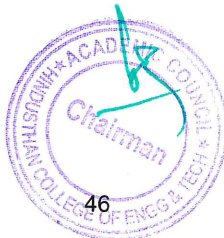
REFERENCE BOOKS:

- R1 - International English Language Testing System Practice Tests, Cambridge University Press..
 R2 - Personality Development (CD-ROM), Times Multimedia, Mumbai.
 R3 - Robert M Sherfield and et al. "Developing Soft Skills" 4th edition, New Delhi: Pearson Education,2009.

WEB SOURCES:

- W1 - <http://www.kent.ac.uk/careers/cv/coveringletters.htm>
 W2 - http://www.mindtools.com/pages/article/newCDV_34.htm

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4701	TECHNICAL SEMINAR/TECHNICAL PUBLICATIONS	0	0	4	2

- Course Objective
1. Train the students to critically evaluate a well-defined set of research subjects.
 2. To summarize the findings concisely in a paper of scientific quality.
 3. Ability to understand a topic, communicate it and identify the issues.
 4. To promote and develop presentation skills and impart a knowledgeable society.
 5. Effective use oral and written forms of communication, that results in integrative thinking.

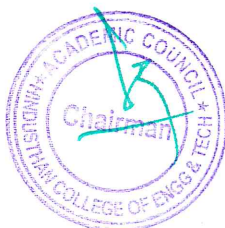
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1. Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2. Every student must write a short review of the topic and present it to fellow students and faculty (discuss the topic – expose the flaws – analyze the issues) every week. The faculty should evaluate the short review and award marks with respect to the following.
 - a. Has the student analyzed – not merely quoted – the most significant portions of the primary sources employed?
 - b. Has the student offered original and convincing insights?
 - c. Plagiarism to be checked.
3. Every student should re-submit and present the review article including issues/ comments/ conclusions which had arisen during the previous discussion.
4. Every student should submit a final paper as per project specifications along with all short review reports (at least 4 internal reviews) and corresponding evaluation comments.
5. Every student should appear for a final external review exam to defend themselves.

Total Practical Hours 45

- Course Outcome
- CO1: understand the role that effective presentations have in public/professional contexts.
 CO2: Gain experience in formal/ informal presentation.
 CO3: Access information in a variety of ways appropriate to a discipline, including locating and using library collections and services and other search tools and databases
 CO4: Obtain, select, store, create and use support materials appropriately
 CO5: Ability to write technical documents and give oral presentations related to the work completed.


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ELECTIVE I & II

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4301	TCP/IP	3	0	0	3

- Course Objective
1. Understand the IP addressing schemes.
 2. Understand the fundamentals of network design and implementation
 3. Understand the design and implementation of TCP/IP networks
 4. Understand on network management issues
 5. Learn to design and implement network applications

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Internetworking concepts and architecture model – class ful Internet address CIDR – Sub netting and Supernetting – AARP – RARP – IP Routing – ICMP – IPV6.	9
	TCP	
II	Services – header – connection establishment and termination – interactive data flow – bulk data flow – timeout and retransmission – persist timer – keep alive timer – futures and performance.	9
	IP IMPLEMENTATION	
III	IP global software organization –routing table–routing algorithms – fragmentation and reassembly – error processing (ICMP) – Multicast Processing (IGMP).	9
	TCP IMPLEMENTATION - I	
IV	Data structure and input processing – transmission control blocks – segment format – comparison–finite state machine implementation – Output processing – mutual exclusion –computing the computing the TCP Data length.	9
	TCP IMPLEMENTATION - II	
V	Timers – events and messages – timer process – deleting and inserting timer event – flow control and adaptive retransmission– congestion avoidance and control – urgent data processing and push function.	9
	Total Instructional Hours	45

- Course Outcome
- CO1 : Design and implement TCP/IP networks
 CO2 : Understand the IP addressing schemes and the fundamentals of network design and implementation
 CO3 :Develop data structures for basic protocol functions of TCP/IP
 CO4 : Understand the Design and implement network applications..
 CO5 : Design the data structures for maintaining multiple local and global timers.

REFERENCE BOOKS :

- R1 - Douglas E Comer, "Internetworking with TCP/IP Volume one", Pearson Education 6thEdition 2013
 R2 - W.Richard Stevens "TCP/IP Illustrated"Vol 1. Pearson Education, 2014
 R3 - Forouzan, " TCP/IP Protocol Suite" Second Edition, Tata MC Graw Hill, 2010

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4302	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

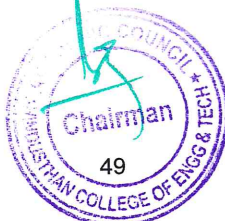
- Course Objective
1. Match organizational needs to the most effective software development model and to Plan and manage projects at each stage of the software development life cycle (SDLC)
 2. Create project plans that address real-world management challenges
 3. Develop the skills for tracking and controlling software deliverables
 4. To learn the cost estimation techniques during the analysis of the project.
 5. To understand the quality concepts for ensuring the functionality of the software

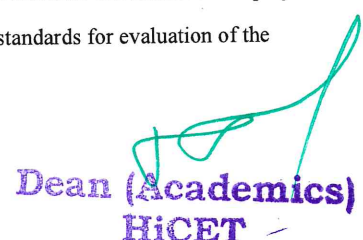
Unit	Description	Instructional Hours
INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT		
I	Project Definition – Contract Management – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.	9
PROJECT EVALUATION		
II	Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.	9
ACTIVITY PLANNING		
III	Objectives – Project Schedule – Sequencing And Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity On Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.	9
MONITORING AND CONTROL		
IV	Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.	9
MANAGING PEOPLE AND ORGANIZING TEAMS		
V	Introduction – Understanding Behavior – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman–Hackman Job Characteristics Model – Working In Groups – Becoming A Team – Decision Making – Leadership – Organizational Structures – Stress – Health And Safety – Case Studies.	9

Total Instructional Hours 45

- Course Outcome
- CO1: Understand the activities during the project scheduling of any software application.
- CO2: Understand the risk management activities and the resource allocation for the projects.
- CO3: Apply the software estimation and recent quality standards for evaluation of the


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software projects

CO4: Acquire knowledge and skills needed for the construction of highly reliable software project

CO5: Create reliable, replicable cost estimation that links to the requirements of project planning and managing

REFERENCE BOOKS :

R1- Bob Hughes and MikeCotterell “Software Project Management”, Third Edition, TATA McGraw Hill Edition 2009.

R2. Royce, “Software Project Theory”, Pearson Education, 2005.

R3.S. A. Kelkar, “Software Project Management: A Concise Study”, PHI Learning, 2013


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4303	SOFTWARE TESTING	3	0	0	3

- Course Objective
1. To introduce the concepts of Software bugs and its impact.
 2. To understand the basic concepts, types and the way in which effective and efficient testing can be performed
 3. To identify the issues in testing management and understand test planning.
 4. To introduce various testing techniques along with software production.
 5. To understand the standard principles to check the occurrence of defects and its removal.

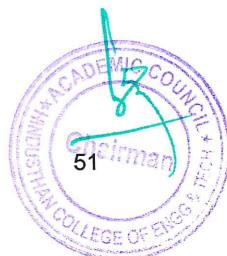
Unit	Description	Instructional Hours
INTRODUCTION		
I	Testing as an Organization –Bugs– Software Bugs – Reasons for Bugs – Cost of Bugs – Responsibilities of Software Tester –Software Development Process: Product Component – Life Cycle Models – Testing Realities	9
TESTING FUNDAMENTALS		
II	Examining the Specification – Testing the Software with Blinders On – Examining the Code – Testing the Software with X Ray Glasses.	9
TESTING TYPES		
III	Configuration Testing - Compatibility Testing: Overview –Platform and Application Version – Standards and Guidelines – Foreign Language Testing: Translation Issues – Localization Issues – Configuration and Compatibility Issues – Usability Testing – Web Site Testing : Black Box Testing – Gray Box Testing – White Box Testing – Configuration and Compatibility Testing – Usability Testing– Functional(Regression) & Non-Functional(Performance) –Agile.	9
AUTOMATED TESTING AND TEST TOOLS		
IV	Benefits – Test Tools – Software Automation – Random Testing – Bug Bashes and Beta Testing: Test Sharing – Beta Testing – Outsourcing Your Testing – Testing for Software Security. Test Documentation : Planning your Test Effort: Goal of Planning – Planning Topics – Writing and Tacking Test Cases: Goal – Test Case Planning– Design – Cases – Procedures – Test Case Organization and Tracking	9
REPORTING THE FINDINGS		
V	Getting Bugs Fixed – Isolating and Reproducing Bugs – Bug Life Cycle – Bug Tracking System – Measuring the Success –KPI's & SLA's Software Quality Assurance: A Case Study on Test Life Cycle	9
Total Instructional Hours		45

- Course Outcome
- CO1: To Understand the tester responsibilities and the software development process.
- CO2: To Understand the fundamentals of testing to perform an effective and efficient testing
- CO3: Test the software by applying testing techniques to deliver a product free from bugs
- CO4: Perform automated testing using test tools and document the testing procedures
- CO5: To Appreciate the bug tracking system and the importance of software quality assurance.

REFERENCE BOOKS :

- R1- Ron Patton, Software Testing, Pearson Education, 2nd Edition, Sixteenth Impression,2011
- R2-Elfriede Dustin, Effective Software Testing, Pearson Education, 2008
- R3- Boris Beizer, Software Testing Techniques, Dream Tech Press, 2009.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA4304	SOFTWARE QUALITY MANAGEMENT	3	0	0	3
Course Objective	1. To introduce the quality management process and its activities 2. To explain the standards and metrics of software. 3. To distinguish between the various activities of quality assurance, quality planning and quality control 4. To understand the importance of standards in the quality management process and their impact on the final product 5. To understand the principles of defect prevention and identify the defects in the software					

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Quality Control & Assurance–Software Process Assessment - Overview – Assessment Phases – Assessment Principles – Assessment Conduct – Implementation Consideration – Quality Management – Quality Assurance Plan – Considerations –Verification and Validation.	9
	CONFIGURATION MANAGEMENT	
II	Need for Configuration Management – Software Product Nomenclature – Configuration Management Functions – Baselines – Responsibilities – Need for Automated Tools – Plan –SCM Support Functions – The Requirement Phase Design Control – The Implementation Phase – Test Phase – SCM Tools – Configuration Accounting and Audit–Release Management Through Source Control.	9
	SOFTWARE STANDARDS AND INSPECTION	
III	Definitions – Reason for Software Standards – Benefits – Establishing Standards – Guidelines – Types of Reviews – Inspection Objectives – Basic Inspection Principles – The Conduct of Inspection – Inspection Training.	9
	TESTING AND MANAGING SOFTWARE QUALITY	
IV	Testing: Principles – Types – Planning – Development – Execution and Reporting –Tools & Methods – Real Time Testing – Quality Management Paradigm – Quality Motivation – Measurement Criteria – Establishing a Software Quality Program – Estimating Software Quality.	9
	DEFECT PREVENTION	
V	Principles of Software Defect Prevention – Process Changes for Defect Prevention – Defect Prevention Considerations – Management Role – Framework for Software Process Change – Managing Resistance to Software Process Change – Case studies	9
	Total Instructional Hours	45
Course Outcome	CO1: Understand the concepts of quality control and quality management in software CO2: Understand the concept of software configuration management CO3: Analyse the different types of software standards for quality assurance CO4: Apply quality assurance tools and techniques to ensure software quality CO5: Illustrate quality assurance plans and prevent the defects in the software	

REFERENCE BOOKS :

- R1-Watts S. Humphrey, "Managing the Software Process, Addison Wesley, Nineteenth Impression", 2013
 R2-Roger Pressman S, "Software Engineering: A Practitioner's Approach", 7th Edition, McGraw Hill, 2010.
 R3 - Jeff Tian, "Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement", wiley India, 2009
 R4 - Chris Hawkins, Margaret Ross, Geoff , "Software Quality Management VI: Quality Improvement Issues", Springer 2012

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Programme MCA	Course Code 16CA4305	Name of the Course CYBER SECURITY	L 3	T 0	P 0	C 3
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- 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	Total Instructional Hours
	DISK FORENSICS	
I	Computer Forensics - Digital data – digital object – digital event – digital device- Hard disk – types of disc – Disk characteristics – file systems - Headers/Magic Numbers- Registry Forensics - Registry – registry data types –RegEdit - Data hiding.	9
	SOFTWARE FORENSICS	
II	Live Forensics, Volatile Live Vs Offline Forensics, Artifacts - System Information - Linux ~ Windows – System commands - Network information – Network commands - Live Forensics scenarios- Obfuscation – code Obfuscation - data hiding in Images - Software Forensic challenges – Principles of Steganography.	9
	NETWORK FORENSICS	
III	Network forensics - vulnerability analysis - Malware Concepts - Virus components- Function of replicator, concealer and dispatcher- Trigger Mechanisms- Virus families - worms & virus - sandboxing - Key Loggers - Port Scans – SYN flood - Email Forensics - email spoofing – Phishing – mail header analysis - Network forensics- Wireshark – Capture and Display Filters - pcap analysis- DoS – DDoS Attacks – types - Honey Pots - Forensic evidences - log analysis & evidence collection.	9
	CYBER SECURITY INTRODUCTION	
IV	History - Critical Characteristics of Information - NSTISSC Security Model - Components an Information system - Securing the components - Balancing Security and Access - The SDLC - The Security SDLC.	9
	SECURITY INVESTIGATION AND ANALYSIS	
V	Need for Security - Threats - Attacks – Legal - Ethical and Professional Issues. Risk Management: Identifying and assessing - Risk Assessing and Controlling Risk.	9
	Total Instructional Hours	45

Course	CO1: Understand and analyze the fundamentals of Disk forensics
Outcome	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:

- R1-Albert J Marcella, et al, Cyber forensics, 2nd edition, Auerbach, 2008
- R2-Harlon Carvey, Windows Registry forensics, Syngress, 2011
- R3-Andrew Hoog, Android forensics, Syngress, 2011
- R4-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	16BA4352	ACCOUNTING AND FINANCIAL MANAGEMENT	3	0	0	3

- Course Objective
1. To enable the students to study the basic accounting concepts and preparation of financial statements.
 2. To enable the students to study the techniques of financial statement analysis
 3. To enable the students to study the application of cost accounting technique to ascertain the cost of products or services
 4. To enable the students to study the cost volume profit analysis and preparation of various budgets in the modern business
 5. To enable the students to study the role of financial management in the modern business enterprise and the appraisal methods on capital assets


Unit	Description	Instructional hours
I	FINANCIAL ACCOUNTING Financial Accounting – Meaning and Definition. Accounting Concepts and conventions. Double entry principles of book keeping. Journal entry-Posting in to Ledger-Preparation of Trial Balance- Preparation of Final Accounts.	10
II	FINANCIAL STATEMENT ANALYSIS Analysis of financial statements -Techniques of Interpretation of financial statements-Comparative statement-Common size statement-Trend analysis-Ratio Analysis- Funds Flow -Cash Flow Analysis.	10
III	COST AND MANAGEMENT ACCOUNTING Definitions Cost Accounting and Management Accounting –Distinction between Financial Accounting with Cost Accounting and Management Accounting. Cost Terminology – functional classification of cost. Cost Centre- Cost Unit. Elements of Cost – Preparation of Cost Sheet	5
IV	MARGINAL COSTING AND BUDGETARY CONTROL Marginal costing - Marginal Costing. Equation-Contribution. Break Even Analysis-Breakeven point- applications of marginal costing- Meaning and need of budgetary control.-Different types of budgets- Preparation of budget -Cash budget- flexible budget and other budgets.	10
V	FINANCIAL MANAGEMENT Financial Management an overview. Objectives and functions of Financial Management- Concept of Time value of money- Techniques in computation of time value of money. Meaning and nature of Capital Budgeting Decision- Methods of appraisal capital budgeting. Non-discounted cash flow techniques and discounted cash flow techniques.	10
Total instructional hours		45

- Course Outcome
- CO1: Students can able to understand the practice of preparation of financial statement in the modern business.
- CO2: Students can able to understand the techniques on analysis of financial statement in the modern business
- CO3: Students can able to understand the application of cost accounting techniques while computing the cost of products and services
- CO4: Students can able to understand the cost volume profit analysis and preparation of various budgets in the modern business
- CO5: Students can able to understand the role of financial management in the modern business enterprise and the appraisal methods on capital assets

Note : 50% Theory, 50 % Problems

REFERENCE BOOKS :

- R1- M.N. Arora, Accounting for Management, Himalaya Publishing House, New Delhi, 2016
R2- Dr.A.Murthy and Dr.S.Gurusamy, Management Accounting, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2015.
R3- Dr. V.R. Palanivelu, Financial Management, S. Chand & Company, New Delhi, 2016
R4- R.S.N.Pillai and V.Bagavathi, Financial Accounting, S.Chand publishing, New Delhi 2012.
R5- R.S.N.Pillai and V.Bagavathi, Management Accounting, S.Chand publishing, New Delhi 2012


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SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5201	PHP PROGRAMMING	3	0	0	3

- Course Objective
1. To understand the basic concepts of PHP programming.
 2. To design HTML web pages, designing web sites using templates and to perform validations.
 3. To understand the OOPS concepts and to improve the performance of Web applications through cookies, caching and buffering.
 4. To design applications using files and database connectivity in PHP
 5. To develop the MVC pattern models

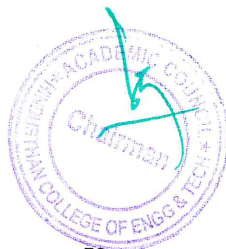
Unit	Description	Instructional Hours
	OPEN SOURCE PROGRAMMING LANGUAGES-PHP	
I	Introduction to PHP Hypertext Processor(PHP) – Programming in Web Environment – Variables – Constants – Data Type – Operators – Decision and Loops Statements – Functions – Arrays - String Manipulation and Regular Expression	9
	WEB DESIGNING TOOLS	
II	HTML – Tags – Forms and Tables – CSS properties and working with Templates, Java Script – Client side validation – JQuery forms – PHP with AJAX	9
	ADVANCED PHP	
III	Object Oriented Programming – Objects – Classes – Polymorphism – Interface – Inheritance and Code Reusability – Exceptional Handling – cookies – caching – buffering	9
	PHP DATABASE CONNECTIVITY	
IV	File Handling and Data Storage – PHP and SQL Database – PHP and Lightweight Directory Access Protocol (LDAP) – PHP Hypertext Processor (PHP) Connectivity – Sending and Receiving E-mails – Templates.	9
	FRAMEWORK	
V	Understanding the MVC pattern models – Cake PHP – Creating up model for database table – Controller – Creating views – Creating Sessions	9
	Total Instructional Hours	45

- Course Outcome
- CO1: Understand the basic concepts of PHP programming.
CO2: Able to design HTML web pages, Designing web sites using templates and to perform validations.
CO3: Understand the OOPS concepts and to improve the performance of Web applications through cookies, caching and buffering.
CO4: Design applications using files and database connectivity in PHP
CO5: Able to deploy the MVC pattern models

REFERENCE BOOKS :

- R1- Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf , “Programming PHP: Creating Dynamic Web Pages” OREILLY, 2013.
R2- Jessica Minnick ,” Web Design with HTML & CSS3: Comprehensive Cengage Learning, 2013
R3- Larry Ullman , PHP Advanced and Object-Oriented Programming: Visual QuickPro Guide, Peachpit Press, 2013
R4- Luke Welling, Laura Thomson ,” PHP and MySQL Web Development”, Pearson Education ,2017.
R5- Bartosz Porebski, Karol Przystalski, Leszek, Building PHP Applications with Symfony, CakePHP, and Zend Framework, Wiley Publishing, 2011

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5202	PYTHON PROGRAMMING	3	0	0	3

- Course Objective
6. Develop an understanding on the basic concepts of Python Programming
 7. To understand File operations, Classes and Objects and regular Expressions.
 8. To design applications using Threads , GUI and web programming
 9. To create Client server networking applications
 10. To develop web applications using Python

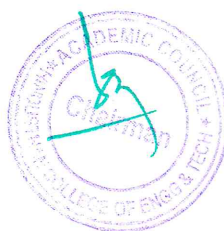
Unit	Description	Instructional Hours
CORE PYTHON		
I	Introduction – Conditional Statements – Looping – Control Statements – String Manipulation – Lists – Tuple – Dictionaries	9
ADVANCED PYTHON - I		
II	Files – Input and Output – Errors and Exceptions – Functions - Modules – Classes and Objects – Regular Expression	9
ADVANCED PYTHON - II		
III	Internet Client Programming – Multithreaded Programming – threads and processes- GUI programming, Advanced CGI – Web Programming	9
NETWORK PROGRAMING		
IV	Introduction to Client – Server Networking, UDP, TCP, Socket names and DNS , HTTP Clients and HTTP Servers	9
WEB DEVELOPMENT		
V	Basic web application structure – Templates – Web Forms – Databases - Email – User Authentication – testing - Deployment	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand the basic concepts of Python programming.
 - CO2: Design applications using Files, Modules, Classes and Objects .
 - CO3: Implement applications using multithreading concepts and development of GUI applications
 - CO4: Design applications using Client Server Networking using TCP, UDP
 - CO5: Able to deploy web Development applications under Flask

REFERENCE BOOKS :

- R1- Kent D. Lee, “ Python Programming Fundamentals”, Springer, 2014
- R2- Wesley J Chun, ”Core Python Programming:, prentice Hall, 2006
- R3- Brandon Rhodes, John Goerzen, ” Foundations of Python Network Programming”Aprèss, 2014
- R4- Miguel Grinberg, ” Flask Web Development: Developing Web Applications with Python”, OReilly, 2014.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5001	PHP LABORATORY	0	0	4	2

- Course Objective
1. To develop Simple programs using arrays, functions and strings
 2. To understand threading concepts to develop web application.
 3. To understand networking concepts to implement TCP and UDP.
 4. To Design and host a user friendly website with authentication features
 5. To understand the basics of PHP programming and create GUI applications, database connectivity.

Expt. No. Description of the Experiments

PHP

- 1 Demonstrate Simple programs using looping, arrays, strings manipulations, classes, objects concepts.
- 2 Develop PHP program using controls and function.
- 3 Implement an application to perform message passing mechanism between pages.
- 4 Develop a PHP program using String function and Arrays.
- 5 Develop a PHP program and check File System functions, Network functions, Date and time functions.
- 6 Develop a PHP program to display student information using MYSQL table.
- 7 Develop a PHP program using parsing functions (use Tokenizing).
- 8 Develop a PHP program and check Regular Expression, HTML functions, Hashing functions.
- 9 Develop a PHP program using cookie and session.
- 10 Develop an online application to illustrate the concept of threads.
- 11 Implement Client Server networking applications using TCP and UDP.
- 12 Create a simple web application with necessary authentication features and testing strategies and deploy it in the web.

Total Practical Hours 45

- Course Outcome
- CO1: Develop Simple to illustrate arrays, functions and strings
CO2: Able to apply the threading concepts to develop web application.
CO3: Design networking concepts to implement TCP and UDP.
CO4: Design, develop and host a user friendly website with authentication features
CO5: Understand the basics of PHP programming and create GUI applications, database connectivity programs and web applications in PHP

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5002	PYTHON PROGRAMMING LABORATORY	0	0	4	2

- Course Objective
1. To understand basics of Python Programming Language
 2. To develop data structures concepts, exceptional Handling and to create and run functions and regular expressions using python.
 3. To design object-oriented programs with Python classes and threading concepts
 4. To Implement Networking Concepts using Python.
 5. To develop Web applications using database connectivity

Expt. No. Description of the Experiments

1. Develop programs to understand the control structures of python
2. Develop programs to learn different types of structures (list, dictionary, tuples) in python
3. Develop programs to learn concept of functions scoping, recursion and list mutability.
4. Develop programs to understand working of exception handling and assertions.
5. Develop programs for data structure algorithms using python searching, sorting and hash tables.
6. Develop programs to learn regular expressions using python.
7. Develop application using multithreading and classes
8. Implement Client Server Programming using TCP
9. Implement Client Server Programming using UDP
10. Develop applications using web application using database connectivity

Total Practical Hours 45

- Course Outcome
- CO1:Design and develop applications using basic concepts of Python
CO2:Implement programs using functions, recursion, mutability exception handling, assertion and Data Structures Algorithm
CO3: Design and Implement applications using classes, objects and Multithreading.
CO4:Design Client / Server applications using Python Programming
CO5:Develop Web Applications using database connectivity


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5801	MINI PROJECT	0	0	8	4

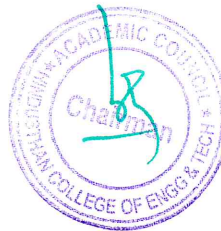
Team Project with a maximum of four in a team

- | 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 | Description |
|----------------|--|
| | 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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ELECTIVE – III

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5301	BIG DATA ANALYTICS	3	0	0	3

- Course Objective
1. To explore the fundamental concepts of big data analytics
 2. To learn to use various techniques for mining data stream.
 3. Learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop.
 4. To understand the various search methods and visualization techniques.
 5. To understand the applications using Map Reduce Concepts.

Unit	Description	Instructional Hours
I	INTRODUCTION TO BIG DATA Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools	9
II	MINING DATA STREAMS 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 - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.	9
III	HADOOP History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features	9
IV	HADOOP ENVIRONMENT Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop– HDFS - Monitoring-Maintenance.	9
V	FRAMEWORKS Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications	9
Total Instructional Hours		45

- Course Outcome
- CO1: Work with big data platform, Analyze the big data analytic techniques for useful business applications
- CO2: Design efficient algorithms for mining the data from large volumes.
- CO3: Analyze the HADOOP and Map Reduce technologies associated with big data analytics
- CO4 : Explore on Big Data applications Using Pig and Hive
- CO5: Understand the fundamentals of various bigdata analysis techniques

REFERENCE BOOKS :

- R1 - Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
- R2 –Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
- R3 - Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
- R4 – AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5302	DATA WAREHOUSING AND DATA MINING	3	0	0	3

- Course Objective
1. To expose the students to the concepts of Data warehousing Architecture and Implementation
 2. To Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
 3. To learn to use association rule mining for handling large data
 4. To understand the concept of classification for the retrieval purposes
 5. To know the clustering techniques in details for better organization and retrieval of data To identify Business applications and Trends of Data mining

Unit	Description	Instructional Hours
	DATA WAREHOUSE	
I	Data Warehousing - Operational Database Systems vs. Data Warehouses - Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP Operations – Data Warehouse Architecture– Indexing – OLAP queries & Tools.	8
	DATA MINING & DATA PREPROCESSING	
II	Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.	9
	ASSOCIATION RULE MINING	
III	Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Itemsets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint-Based Association Mining.	8
	CLASSIFICATION & PREDICTION	
IV	Classification vs. Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation Associative Classification – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.	10
	CLUSTERING	
V	Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis	10
Total Instructional Hours		45

- Course Outcome
- CO1: Apply the association rules for mining the data
CO2: Design and deploy appropriate classification techniques
CO3: Cluster the high dimensional data for better organization of the data
CO4: Evolve Multidimensional Intelligent model from typical system
CO5: Evaluate various mining techniques on complex data objects

REFERENCE BOOKS

- R1 - Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2012.
R2 - K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2012.
R3 - G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
R4 - BERSON, ALEX & SMITH, STEPHEN J, Data Warehousing, Data Mining, and OLAP, TMH Pub. Co. Ltd, New Delhi, 2012
R5 - Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5303	CLOUD COMPUTING	3	0	0	3


- Course Objective
1. Understand the cloud environment and building software systems and components that scale to millions of users in modern internet
 2. Understand the key dimensions of the challenge of Cloud Computing
 3. Understand the cloud concepts and capabilities across the various cloud service models
 4. Develop cloud based software applications on top of cloud platforms.
 5. Explain the core issues of cloud computing such as security

Unit	Description	Instructional Hours
	CLOUD COMPUTING – ARCHITECTURE	
I	Cloud Computing –History of cloud computing –Cloud Architecture –Cloud Storage –Need for Cloud Computing –Advantages – Architecture of Cloud – Cloud Services.	9
	CLOUD VIRTUALIZATION	
II	Basics of Virtualization – Types and Implementation levels - Types of Cloud Service Development – –On Demand Computing –Amazon Ec2 –Virtualization of CPU, Memory, I/O Devices.	9
	INFRASTRUCTURE	
III	Architectural Design of Storage Clouds – Design Challenges – Inter Cloud Resource Management – Platform Deployment – Virtualization of Data Centre automation - Hybrid storage networking technologies.	9
	PROGRAMMING PARADIGMS	
IV	MapReduce, Twister and Iterative MapReduce – Hadoop Library from Apache – Google App Engine – Amazon AWS – Eucalyptus – Open Nebula – Aneka.	9
	SECURITY	
V	Security Challenges and Risks – Software as Service Security – Risk Management – Security Monitoring – Identity Management.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Able to Articulate the basic concepts of cloud and its architecture.
CO2: Able to understand virtualization concepts.
CO3: Understand Cloud storage and its networking technologies.
CO4: Understand the Programming Paradigms.
CO5: Able to describe the prevalent security challenges in the cloud.

REFERENCE BOOKS

- R1-Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2012.
R2-Kai Hwang, Geoffrey C Fox & Jack G Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
R3:JohnW.Rittinghouse& James F.Ransome, "Cloud Computing: Implementation Management, and Security", CRC Press, 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5304	MOBILE COMPUTING	3	0	0	3

Course Objective	Description
	1. Understand the basic concepts of mobile computing
	2. Be familiar with the network protocol stack
	3. Learn the basics of mobile telecommunication system
	4. Be exposed to Ad-Hoc networks
	5. Gain knowledge about different mobile platforms and application development

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	9
	MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER	
II	Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.	9
	MOBILE TELECOMMUNICATION SYSTEM	
III	Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	9
	MOBILE AD-HOC NETWORKS	
IV	Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security	9
	MOBILE PLATFORMS AND APPLICATIONS	
V	Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone	9
Total Instructional Hours		45

Course Outcome	Description
	CO1: Explain the basics of mobile telecommunication system
	CO2: Choose the required functionality at each layer for given application
	CO3: Identify solution for each functionality at each layer.
	CO4: Understand the basics of Ad hoc networks
	CO5: Identify the different types of mobile platform

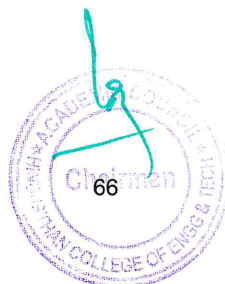
REFERENCE BOOKS:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition ,2006.
4. C.K. Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

WEB SOURCES:

1. Android Developers : <http://developer.android.com/index.html>
2. Apple Developer : <https://developer.apple.com/>
3. Windows Phone Dev Center : <http://developer.windowsphone.com>
4. BlackBerry Developer : <http://developer.blackberry.com/>

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5305	SEMANTIC WEB SERVICES	3	0	0	3

- Course Objective
1. Categories of ontologies and need and architecture of semantic web.
 2. Languages for representing semantic web.
 3. Ontology algorithm and evaluation.
 4. Constructing ontology using different tools.
 5. Potential applications of ontologies in web services

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Components – Types – Ontological Commitments – Ontological Categories –Philosophical Background - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture.	9
	LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES	
II	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
	ONTOLOGY LEARNING FOR SEMANTIC WEB	
III	Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Evaluation	9
	ONTOLOGY MANAGEMENT AND TOOLS	
IV	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
	APPLICATIONS	
V	Web Services – Semantic Web Services - Case Study for specific domain – Security issues – current trends.	9
Total Instructional Hours		45

- Course Outcome
- CO1:Develop integrated, ontology-based or ontology-mediated, applications based on knowledge level.
CO2:Investigate foundational modeling aspects
CO3:Develop tools for ontology development.
CO4:Identify ontology-based data access and integration, combining rules with ontology and computational linguistics.
CO5:Apply fundamental concepts like importing and processing Ontology of the semantic web.

REFERENCE BOOKS

- R1 - Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, "Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web" Springer, 2010 .(Covering Units I, II, III)
R2 - Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2012 . (Covering Units IV, V)
R3 - Dieter Fensel, James Hendler, Henry Lieberman and Wolfgang Wahlster, Spinning the Semantic Web: Bringing the world wide web to its fullpotential. New Delhi: The MIT Press, 2005. (Covering Unit I)
R4 - Shelley Powers, Practical RDF.1stEdition ,Mumbai: O'reilly publishers, 2003. (Covering Units II)

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5306	SECURITY IN COMPUTING	3	0	0	3

- Course Objective
1. To understand the basics of cryptography
 2. Learn to find the vulnerabilities in programs and to overcome them,
 3. know the different kinds of security threats in networks and its solution
 4. know the different kinds of security threats in databases and solutions available
 5. learn about the models and standards for security.

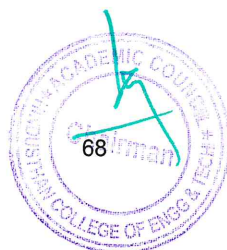
Unit	Description	Instructional Hours
ELEMENTARY CRYPTOGRAPHY		
I	Terminology and Background – Substitution Ciphers – Transpositions – Making Good Encryption Algorithms- Data Encryption Standard- AES Encryption Algorithm – Public Key Encryption – Cryptographic Hash Functions – Key Exchange – Digital Signatures – Certificates	9
PROGRAM SECURITY		
II	Secure programs – Non-malicious Program Errors – Viruses – Targeted Malicious code – Controls Against Program Threat – Control of Access to General Objects – User Authentication – Good Coding Practices – Open Web Application Security Project Flaws – Common Weakness numeration Most Dangerous Software Errors.	9
SECURITY IN NETWORKS		
III	Threats in networks – Encryption – Virtual Private Networks – PKI – SSH – SSL – IPsec – Content Integrity – Access Controls – Wireless Security – Honeypots – Traffic Flow Security – Firewalls – Intrusion Detection Systems – Secure e-mail.	9
SECURITY IN DATABASES		
IV	Security requirements of database systems – Reliability and Integrity in databases –Redundancy – Recovery – Concurrency/ Consistency – Monitors – Sensitive Data – Types of disclosures – Inference-finding and confirming sql injection.	9
SECURITY MODELS AND STANDARDS		
V	Secure SDLC – Secure Application Testing – Security architecture models – Trusted Computing Base– Bell-LaPadula Confidentiality Model – Biba Integrity Model – Graham-Denning Access Control Model – Harrison-Ruzzo-Ulman Model – Secure Frameworks – COSO – CobiT – Compliances – PCIDSS – Security Standards - ISO 27000 family of standards – NIST	9
Total Instructional Hours		45

- Course Outcome
- CO1: Apply cryptographic algorithms for encrypting and decryption for secure data transmission
CO2: Understand the importance of Digital signature for secure e-documents exchange
CO3: Understand the program threats and apply good programming practice
CO4: Get the knowledge about the security services available for internet and web applications
CO5: Understand data vulnerability and sql injection

REFERENCE BOOKS:

- R1 - Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fifth Edition, Pearson Education, 2015.
R2 - Michael Whitman, Herbert J. Mattord, "Management of Information Security", Third Edition, Course Technology, 2010.
R3 - William Stallings, "Cryptography and Network Security : Principles and Practices", Fifth Edition, Prentice Hall, 2010.

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ELECTIVE-IV & V

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5307	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

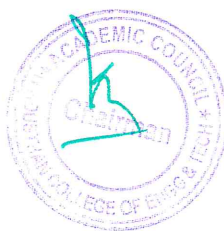
Unit	Description	Instructional Hours
	INTRODUCTION	
I	HTML coding - Basic web graphics - Web page design and site building - Image maps - Adding multimedia to the web- Vector and Raster graphics.	9
	RASTER IMAGE EDITING SOFTWARE	
II	Introduction - Image Basics - File Formats - GIF - JPEG - Color Palette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

- 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 :

- R1 - Jon Duckett, HTML & CSS design and Build Web Sites John Wiley & Sons, 2011.
 R2 -Andrew Rapo, Alex Michael,“Understanding Macromedia Flash 8 ActionScript 2: Basic Techniques for Creatives”Focal press Taylorand Francis group, 2013
 R3 - Andrew Faulkner, Conrad ChavezAdobe Photoshop CC Classroom in a Book (2017 release)

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5308	MIDDLEWARE TECHNOLOGY	3	0	0	3

- Course Objective
1. Understand different types of client server computing models and also Benefits of client server computing, pitfalls of client server programming
 2. Establish communication between client and server through java RMI and JDBC
 3. Understand Middleware Interoperability.
 4. Carry out client server communication using heterogeneous programming languages using CORBA.
 5. Learn java bean component model EJBs and CORBA

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction to client server computing: Evolution of corporate computing models from centralized to distributed computing, client server models, Benefits of client server computing, pitfalls of client server programming. CORBA with Java: Review of Java concept like RMI, RMI API, JDBC. Client/Server CORBA-style	9
	CORBA WITH JAVA	
II	Review of Java concept like RMI, RMI API, JDBC. Client/Server CORBA-style, The object web: CORBA with Java. Core CORBA / Java: The object web: CORBA with Java. Two types of Client/Server invocations-static, dynamic, static CORBA, first CORBA program, ORBlets with Applets	9
	DYNAMIC CORBA	
III	Dynamic CORBA- Portable count Existential CORBA : CORBA initialization protocol, CORBA activation services, CORBAIDL mapping CORBA java- to- IDL mapping, The introspective CORBA/Java object.	9
	JAVA BEAN MODEL	
IV	Java Bean Component Model : Events, properties, persistency, Introspection of beans, CORBA Beans, Implementation of beans.	9
	EJBS AND CORBA	
V	Object transaction monitors CORBA OTM's, EJB and CORBA OTM's, EJB container frame work, Session and Entity Beans, The EJB client/server development Process, EJB design Guidelines..	9
Total Instructional Hours		45

- Course Outcome
- CO1: Know client server computing models and can establish communication between them
CO2: Design a dynamic remote application with RMI and JDBC Connectivity
CO3: Learn how to use Middleware to Build Distributed Applications using Beans.
CO4: Differentiate homogeneous and heterogeneous language communications.
CO5: Develop real time projects by combining CORBA and database interfacing

REFERENCE BOOKS:

- R1 - Client/Server programming with Java and CORBA Robert Orfali and Dan Harkey, John Wiley & Sons, SPD 2nd Edition
R2 – Java programming with CORBA 3rd Edition, G.Brose, A Vogel and K.Duddy, Wiley-dreamtech, India John wiley and sons
R3 - Distributed Computing, Principles and applications, M.L.Liu, Pearson Education
R4 – Client/Server Survival Guide 3rd edition Robert Orfali Dan Harkey& Jeri Edwards, John Wiley & Sons

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5309	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3

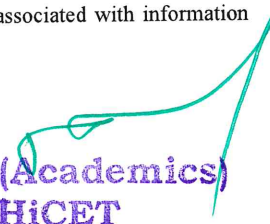
- Course Objective
1. Understand the basic concepts and technologies used in the field of management information systems.
 2. Create the processes of developing and implementing information systems.
 3. Know the role of information systems in organizations, the strategic management processes, and the implications for the management.
 4. Able to understand the usage of Information Systems in management.
 5. Understand the activities that are undertaken in acquiring an Information System in an organization.

Unit	Description	Total Instructional Hours
SYSTEM CONCEPTS		
I	Definition – Computer Based User Machine System – Integrated System – Need for a Database –Utilization of Models – Evolution – Subsystems – Organizational Subsystems – Activities Subsystems.	7
ORGANIZATIONAL MODEL AND ORGANISATION STRUCTURE		
II	Basic Model – Hierarchical – Specialization – Formalization – Centralization - Modifications of Basic Organizational Structure – Project Organization – Lateral Relations – Matrix Organization – Organizational Culture and Power Organizational Change.	9
STRUCTURE OF MIS		
III	Operating Elements – Physical Components – Processing Functions – Outputs – MIS support for Decision Making – Structured Programmable Decisions – Unstructured Non-Programmable Decisions – MIS Structure Based on Management Activity and Organizational Functions – Synthesis of MIS Structure.	10
SYSTEM SUPPORT		
IV	Data Representation – Communication Network – Distributed Systems – Logical Data Concepts –Physical Storage Devices – File Organizations – Database Organization – Transaction Processing	10
DEVELOPMENT AND MANAGEMENT		
V	A Contingency Approach to Choosing an Application – Developing Strategy – Life Cycle Definition Stage – Life & cycle Development Stage – Life & cycle Installation and Operation Stage – Project Management .	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand the basic concepts and technologies used in the field of management information systems
- CO2: Understand the processes of developing and implementing information systems
- CO3: Understand the role of information systems in organizations, the strategic management processes, and the implications for the management
- CO4: Develop an understanding of how various information systems work together to accomplish the information objectives of an organization
- CO5: Understand about the importance of managing organizational change associated with information systems implementation



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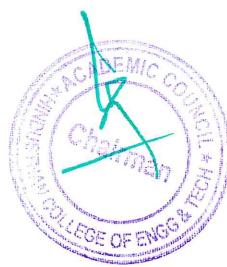



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REFERENCE BOOKS:

- R1- E.Wainright Martin, Carol V. Brown, Danial W. DeHayes, Jeffrey A. Hoffer & William C.Perkins, "Managing Information Technology", 7th Edition, International 2014.
- R2- Kenneth C. Laudon, Jane P. Laudon, & Mary E. Brabston "Management Information Systems – Managing the Digital Firm", Fourth Edition, Kenneth C. Laudon, Jane P. Laudon, & Mary E. Brabston Pearson Prentice Hall, 2008.
- R3-Kenneth, Laudon and Jane Laudon, MIS: Managing the Digital Firm. Pearson Education. 14th edition 2015.


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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5310	E-COMMERCE	3	0	0	3

Course Objective	Objectives
	<ol style="list-style-type: none"> To understand the concepts of e-commerce Provide an overview of the Network Infrastructure and acquire knowledge about ecommerce models. To know and understand the e-advertising and marketing strategies. How companies use ecommerce to gain competitive advantage To understand the electronic data exchange and e-security

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Framework, Architecture, Benefits and Impact of e-Commerce, The Anatomy of e-Commerce applications, e-Commerce Consumer applications, e-Commerce Organisation Applications, ecommerce in India, Prospects of e-commerce.	9
	NETWORK INFRASTRUCTURE & E-COMMERCE MODELS	
II	Intranet, Extranet, & Internet, Internet Backbone in India, ISP and services in India, OSI Model, Standards & Overview of TCP/IP, Internet Security, ecommerce & Internet.	9
	E-ADVERTISING & MARKETING	
III	The new age of information-based Marketing, Emergence of internet as a competitive advertising media, Market Research, Weakness in Internet Advertising, eAdvertising & Marketing in India.	9
	ELECTRONIC PAYMENT SYSTEMS	
IV	Introduction to Payment Systems, On-Line Payment Systems, Pre-Paid e-Payment System, Post-Paid e-Payment System, Requirements Metrics of a Payment System.	9
	ELECTRONIC DATA EXCHANGE & E-SECURITY	
V	EDI- Definitions & Applications, Standardisation and EDI, EDI, Legal Security and Privacy Issues, E-Security: Securing the Business on Internet- Security Policy, Procedures and Practices, Transaction Security, Cryptology, Digital Signatures, Security Protocols for Web Commerce.	9
Total Instructional Hours		45

Course Outcome	Outcomes
	CO1: Understand the Ecommerce Anatomy and Framework CO2: Analyze the impact of Ecommerce on business models CO3: Impact of E-advertising and Marketing in ECommerce CO4: Access of Electronic Payment Systems in ECommerce CO5: Recognize and discuss legal and privacy issues and procedures and practices of ESecurity

REFERENCE BOOKS:

- R1 - Zheng Qin "Introduction to E-commerce", Springer, 2010
- R2 - David Whiteley: E-Commerce- Strategy technologies and Applications, Tata Mc-Graw Hill, New Delhi, 2009. E-Commerce- Strategy technologies and Applications
- R3 - P.T. JOSEPH, E-COMMERCE, Fifth Edition: AN INDIAN PERSPECTIVE, PHI Learning 2015

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CA5311	PROFESSIONAL ETHICS	3	0	0	3

- Course Objective
1. To understand the concepts of computer ethics in work environment.
 2. To understand the threats in computing environment
 3. To understand the intricacies of accessibility issues
 4. To Understand what morality is and how it connects to professional ethics
 5. To ensure safe exits when designing the software projects

Unit	Description	Instructional Hours
	COMPUTER ETHICS INTRODCUTION AND COMPUTER HACKING	
I	A general Introduction – 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
	ASPECTS OF COMPUTER CRIME AND INTELLECTUAL PROPERTY RIGHTS	
II	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
	REGULATING INTERNET CONTENT, TECHNOLOGY AND SAFETY	
III	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
	COMPUTER TECHNOLOGIES ACCESSIBILITY ISSUES	
IV	Introduction – Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace – Introduction – computers and employment–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
	SOFTWARE DEVELOPMENT AND SOCIAL NETWORKING	
V	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: Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- CO2: Develop a responsible attitude towards the use of computer as well as the technology.
- CO3: Able to envision the societal impact on the products/ projects they develop in their career
- CO4: Understanding the code of ethics and standards of computer professionals.
- CO5: Analyze the professional responsibility and empowering access to information in the work place.

REFERENCE BOOKS:

- R1 - Penny Duqueno, Simon Jones and Barry G Blundell, “Ethical , legal and professional issues in computing”, Middlesex University Press, 2008
- R2 - George Reynolds, “Ethics in Information Technology”, Cengage Learning, 2011
- R3 - Caroline Whitback, “Ethics in Engineering Practice and Research”, Cambridge University Press, 2011
- R4 - Richard Spinello, “Case Studies in Information and Computer Ethics”, Prentice Hall, 2007.
- R5 - John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press, 2007.
- R6 - Sara Baase, “A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet”, 3rd Edition, Prentice Hall, 2008

URL

- 1 - http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16BA5353	HUMAN RESOURCE MANAGEMENT	3	0	0	3

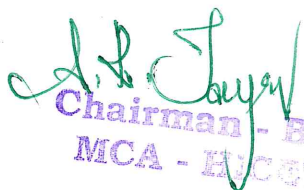
- Course Objective
1. To understand the importance of human resources.
 2. To describe the steps involved in the human resource planning process
 3. To understand the stages of employee socialization and training needs.
 4. To know about the purposes of performance management systems and appraisal.
 5. To know the list of occupational safety and health administration enforcement priorities.

Unit	Description	Instructional Hours
	PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT	
I	Evolution of Human Resource Management – the Importance Of The Human Factor – Objectives Of Human Resource Management – Role Of Human Resource Manager – Human Resource Policies – Computer Applications In Human Resource Management.	9
	THE CONCEPT OF BEST FIT EMPLOYEE	
II	Importance of Human Resource Planning – Forecasting Human Resource Requirement – Internal and External Sources. Selection Process-Screening – Tests - Validation – Interview - Medical Examination – Recruitment Introduction – Importance – Practices – Socialization Benefits.	9
	TRAINING AND EXECUTIVE DEVELOPMENT	
III	Types of Training, Methods, Purpose, Benefits And Resistance. Executive Development Programmes – Common Practices - Benefits – Self Development – Knowledge Management.	9
	SUSTAINING EMPLOYEE INTEREST	
IV	Compensation Plan – Reward – Motivation – Theories of Motivation – Career Management – Development, Mentor – Protégé Relationships.	9
	PERFORMANCE EVALUATION AND CONTROL PROCESS	
V	Method of Performance Evaluation – Feedback – Industry Practices. Promotion, Demotion, Transfer And Separation – Implication Of Job Change. The Control Process – Importance – Methods – Requirement Of Effective Control Systems Grievances – Causes – Implications – Redressal Methods.	9
	Total Instructional Hours	45

- Course Outcome
- CO1: Explain the importance of human resources and their effective management in organizations
CO2: Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs
CO3: Describe the meanings of terminology and tools used in managing employees effectively
CO4: Understand governmental regulations affecting employees and employers
CO5: Analyze the key issues related to administering the human elements such as motivation, compensation, appraisal, career planning, diversity, ethics, and training

REFERENCE BOOKS :

- R1- David A Decenzo, Stephen P. Robbins (Author), Susan L. Verhulst "Fundamentals of Human Resource Management" Wiley Publications, 11th Edition , 2013
R2-Biswajeet Pattanayak, Human Resource Management, Prentice Hall of India, 2014
R3-Robert L. Mathis, John H. Jackson, Human Resource Management, 2015, 15th edition
R4- Gary Dessler Human Resource Management, Pearson Education Limited, 2014.
R5-Ivancevich, Human Resource Management, McGraw Hill 11th edition 2010


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OPEN ELECTIVES

Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CAX4XX	NETWORK SECURITY	3	0	0	3

- Course Objective
1. Understand security concepts, Understand security threats.
 2. Comprehend and apply relevant cryptographic techniques.
 3. Comprehend and apply authentication services and mechanisms.
 4. Comprehend and apply email security services and mechanisms.
 5. Comprehend and apply web security services and mechanisms.

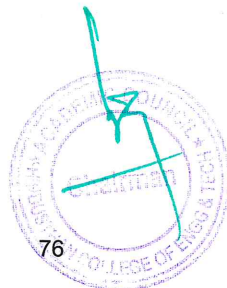
Unit	Description	Instructional Hours
	SECURITY SERVICES	
I	Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services and Mechanisms - A model for Internetwork security - Buffer overflow & format string vulnerabilities - TCP session hijacking - route table modification, man-in-the-middle attacks.	9
	ALGORITHMS AND HASHING	
II	Encryption Principles - Encryption algorithms - cipher block modes of operation - key distribution Approaches of Message Authentication - Secure Hash Functions and HMAC.	9
	KEY MANAGEMENT	
III	Public key cryptography principles - algorithms, digital signatures - digital Certificates - Certificate Authority and key management Kerberos - X.509 Directory Authentication Service.	9
	IP SECURITY	
IV	Email privacy: Pretty Good Privacy (PGP) and S/MIME. IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.	9
	IDS	
V	Viruses and related threats, Intruders, Firewall Design principles, Trusted Systems. Intrusion Detection Systems.	9
	Total Instructional Hours	45

- Course Outcome
- CO1: Understand security attacks and services.
 CO2: Explain different cryptographic algorithms
 CO3: Gain knowledge about digital signatures and key management.
 CO4: To state IP security and mail privacy.
 CO5: Explain issues related to the security of web services.

REFERENCE BOOKS:

- R1 - Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
 R2 - Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W. Manzuik and Ryan Perme, Wiley Dreamtech
 R3- Cryptography and network Security, Third edition, Stallings, PHI/Pearson

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Programme	Course Code	Name of the Course	L	T	P	C
MCA	16CAX4XX	FUNDAMENTALS OF CLOUD COMPUTING	3	0	0	3

- Course Objective
1. Understand the components of cloud computing.
 2. Evaluate information storage management design in a cloud environment
 3. Discuss data centre networking technologies and protocols.
 4. Assess the security of virtual systems.
 5. Discuss and evaluate the management of complex virtual environments.

Unit	Description	Instructional Hours
	CLOUD COMPUTING FUNDAMENTALS	
I	Cloud Computing definition - private, public and hybrid cloud - Cloud types - IaaS, PaaS, SaaS - Benefits and challenges of cloud computing - public vs private clouds - role of virtualization in enabling the cloud - Benefits and challenges to Cloud architecture - security and disaster recovery.	9
	CLOUD STORAGE INFRASTRUCTURES	
II	Architecture of storage, analysis and planning - Storage network design considerations - NAS and FC SANs - hybrid storage networking technologies - design for storage virtualization in cloud computing.	9
	EVOLUTION OF DATA CENTRE DESIGN	
III	Design for flexibility – scalability - environmental control - electrical power – flooring - fire protection – security - network infrastructure - Energy use and greenhouse gas emissions - Requirements for modern data centers - high availability and Service Orientated Infrastructures (SOI).	9
	MULTI-TENANCY ISSUES-	
IV	Isolation of users/VMs from each other - Virtualization System Security Issues ESX file system security - storage considerations - backup and recovery - Virtualization System Vulnerabilities - Management server vulnerabilities - hypervisor vulnerabilities - configuration issues - malware (botnets etc).	9
	PERFORMANCE MANAGEMENT IN A VIRTUAL ENVIRONMENT	
V	Management techniques - methodology and key performance metrics used to identifying CPU, memory, network - virtual machine and application performance bottlenecks in a virtualized environment.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand cloud computing fundamentals.
 - CO2: Explain different storage network designs.
 - CO3: State network centre designs.
 - CO4: Describe virtualization vulnerabilities.
 - CO5: Explain virtual machine performance and its bottlenecks.

REFERENCE BOOKS:

- R1 - Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, Lambert Academic Publishing, 2012
- R2 - Greg Schulz, Cloud and Virtual Data Storage Networking, Auerbach Publications, 2011
- R3 - Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, 2009.


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Course Code & Name		20CA1204 Database Management Systems												
PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3		3		0	0	0	2	3	1
CO2	3	3	3	3	3		3		0	0	0	2	3	1
CO3	3	3	3	3	3	3	3	2	0	0	0	2	3	1
CO4	3	3	3	3	3	3	2	2	0	0	0	2	3	2
CO5	3	3	3	3	3	3	3	2	0	0	0	2	3	1
Average	3	3	3	2.8	3	3	2.8	2	0	0	0	2	3	1.2

Course Code & Name		20CA1001 Java Programming Lab												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	1	0	3	0	3	3	3	3	1	0	2
CO2	0	0	0	0	0	3	0	3	3	3	3	1	0	2
CO3	0	0	0	0	0	0	0	1	3	3	3	1	0	2
CO4	0	0	0	0	0	0	1	1	3	3	3	1	0	1
CO5	0	0	0	0	0	0	0	1	3	3	3	1	0	2
Average	0	0	0	0.2	0	1.2	0.2	1.8	3	3	3	1	0	1.8

Course Code & Name		20CA1002 DBMS Lab												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	1	0	0	2	3	3
CO2	3	3	2	2	3	1	3	3	1	0	0	2	3	3
CO3	3	3	2	2	3		3	3	1	0	0		3	3
CO4	3	3	2	2	3	3	3	3	1	0	0	3	3	3
CO5	3	3	3	3	3		3	2	1	0	0		3	3
Average	3.0	3.0	2.4	2.2	3.0	2.3	3.0	2.8	1.0	0.0	0.0	2.3	3.0	3.0

Course Code & Name		20CA1171 Communicative Skill for Business English												
PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	2	2	2	1	1	2	1	3	3	0	2	2	1
CO2	2	2	0	0	1	2	2	0	2	3	0	2	2	1
CO3	2	2	0	1	2	2	1	1	3	3	0	3	2	1
CO4	2	2	1	0	1	1	0	2	2	2	0	2	2	2
CO5	2	1	1	2	3	2	0	0	2	3	0	2	2	1
Average	2.2	1.8	0.8	1	1.6	1.6	1	0.8	2.4	2.8	0	2.2	2	1.2

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

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

Course Code & Name		20CA2201 Data Structures and Algorithms													
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1	
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2	
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1	
CO4	0	3	3	2	3	0	2	3	0	2	3	3	3	1	
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2	
Average	1.6	1.2	1.2	1.2	1.2	1.6	1.2	1.2	1.6	1.2	1.2	1.2	1.2	1.4	

Course Code & Name		20CA2202 Software Engineering												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.6	1.25	1.25	1.2	0.5	1.6	1.2	0.5	1.6	1.2	0.5	0.5	0.5	1.4

Course Code & Name		20CA2203 Python Programming												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	3	3	3	2	3	0	3	0	0	0	0	0	3	1
CO2	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO3	3	3	3	3	3	0	3	0	0	0	0	0	3	1
CO4	3	3	3	3	3	0	2	0	0	0	0	0	3	2
CO5	3	3	3	3	3	0	3	0	0	0	0	0	3	1
average	3	3	3	2.8	3	0	2.8	0	0	0	0	0	3	1.2

Course Code & Name		20CA2204 Data Science Using Python												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	1.6	1.25	1.25	1.2	0.75	1.6	1.2	0.75	1.6	1.2	0.75	0.75	0.75	1.4

Course Code & Name **20CA2001 Python Programming Lab**

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

Course Code & Name **20CA2002 Data Structures & Algorithms Lab**

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

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

Academic Year 2020 - 2021 - Semester – V - Batch (2018 - 2021)

Course Code & Name **16CA5201 PHP Programing**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	2	0	0	0	0	2	0	0	2	0	0	0	0	1
Average	2.8	0	0	0.8	0	2.8	0.8	0	2.8	0.8	0	0	0	1.8

Course Code & Name **16CA5202 Python Programming**

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

Course Code & Name **16CA5001 PHP Programming Lab**

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

Course Code & Name **16CA5002 Python Programming Lab**

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

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

Academic Year 2020 - 2021 - Semester – V - List of Electives - Batch (2018 - 2021)

Course Code & Name **16CA5301 Big Data Analytics**

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

Course Code & Name **16CA5303 Cloud Computing**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.2	0.6	0.6	1.4	0.6	2.2	1.4	0.6	2.2	1.4	0.6	0.6	0.6	2.4

Course Code & Name **16CA5304 Mobile Computing**

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	2.0	1.0	1.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	0.0	0.0	3.0

Average	2.0	0.7	0.7	0.8	0.3	2.0	0.8	0.3	2.0	0.8	0.3	0.3	0.3	1.8
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Course Code & Name		16CA5305 Semantic Web Services												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO4	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.4	1.5	1.5	1.4	0.75	1.4	1.4	0.75	1.4	1.4	0.75	0.75	0.75	1.6

Course Code & Name		16CA5306 Security in Computing												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	0	1	2	0	1	2	0	1	1	1	1
CO2	1	3	3	3	3	1	3	3	1	3	3	3	3	2
CO3	3	0	0	1	3	3	1	3	3	1	3	3	3	2
CO4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	1.8	1.4	1.4	1.4	1.4	1.8	1.4	1.4	1.8	1.4	1.4	1.4	1.4	1.6

Course Code & Name		16CA5307 Web Graphics												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	0	3	0	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	0	3	3	0	3	3	0	0	0	3
Average	3	3	2.4	3	1.8	3	3	2.4	3	3	2.4	2.4	2.4	3

Course Code & Name		16CA5308 Middleware Technologies												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO3	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO4	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.2	0.6	0.6	1	0.6	2.2	1	0.6	2.2	1	0.6	0.6	0.6	1.6

Course Code & Name		16CA5309 Management Information System												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	1.8	1.0	1.0	1.0	0.3	1.8	1.0	0.3	1.8	1.0	0.3	0.3	0.3	1.6

Course Code & Name		16CA5310 E-Commerce												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	3	0	0	1	0	3	1	0	3	1	0	0	0	2
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.4	0.2	0.2	0.8	0.2	2.4	0.8	0.2	2.4	0.8	0.2	0.2	0.2	1.8

Course Code & Name		16CA5311 Professional Ethics												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	0	3	3	2	3	0	2	3	0	2	3	3	3	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	0	3	3	2	0	0	2	0	0	2	0	0	0	1
Average	1.2	1.75	1.75	1.2	1	1.2	1.2	1	1.2	1.2	1	1	1	1.4

Course Code & Name		16CA5353 Human Resource Management												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO3	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	1	2	2	3	0	1	3	0	1	3	0	0	0	2
Average	1.8	1.0	1.0	1.0	0.3	1.8	1.0	0.3	1.8	1.0	0.3	0.3	0.3	1.6

Course Code & Name		16CAX4XX Network Security												
PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	1	2	2	3	2	1	3	2	1	3	2	2	2	2
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	2	0	0	0	0	2	0	0	2	0	0	0	0	1
Average	1.8	1	1	1.4	0.8	1.8	1.4	0.8	1.8	1.4	0.8	0.8	0.8	2

Course Code & Name		16CAX4XX Fundamentals of Cloud Computing												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	2	0	0	2	0	0	0	0	1
CO2	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO3	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO4	2	1	1	2	1	2	2	1	2	2	1	1	1	3
CO5	3	0	0	1	0	3	1	0	3	1	0	0	0	2
Average	2.2	0.6	0.6	1.4	0.6	2.2	1.4	0.6	2.2	1.4	0.6	0.6	0.6	2.4

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

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO	PSO	PSO2	
												10	11	12			
															1		
I	I	20MA1101- Probability, Statistics and Operations Research	2.4	2.8	2.4	1.4	1.6	2	0	0	0	0	0	1	1.4	2	2.2
		20CA1201- UI Design and Development	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.6
		20CA1202 Computer Networks	2	1.8	2	2.2	2	1	0	0	0	0	0	0	0	2	1.8
		20CA1203 - Java Programing	3	3	3	3	3	0	3	2	0	0	0	3	3	3	3
		20CA1204 - Database management system	3	0	0	1	0	3	1	0	3	1	0	0	0	0	2
		20CA1001 - Java Programing Lab	0	0	0	0.2	0	1.2	0.2	1.8	3	3	3	3	1	0	1.8
		20CA1002 - Database management system Lab	3.0	3.0	2.4	2.2	3.0	2.3	3.0	2.8	1.0	0.0	0.0	2.3	3.0	3.0	
		20CA1171 - Communication Skill for Business English	2.2	1.8	0.8	1	1.6	1.6	1	0.8	2.4	2.8	0	2.2	2	1.2	

Academic Year 2020 - 2021 - Semester – II - Btch 2021 - 2023 2020R

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO	PSO	PSO2	
												10	11	12			
															1		
II	II	20CA2201 Ddata Structures and algorithms	1.6	1.2	1.2	1.2	1.2	1.6	1.2	1.2	1.6	1.2	1.2	1.2	1.2	1.4	
		20CA2202 - Software Engineering	1.6	1.25	1.25	1.2	0.5	1.6	1.2	0.5	1.6	1.2	0.5	0.5	0.5	1.4	
		20CA2203 - Python Programming	3	3	3	2.8	3	0	2.8	0	0	0	0	0	0	3	1.2
		20CA2204 - Data Science using Python	1.6	1.3	1.3	1.2	0.8	1.6	1.2	0.8	1.6	1.2	0.8	0.8	0.8	1.4	
		20CA2001 - Python Programming Lab	3	0	0	1	0	3	1	0	3	1	0	0	0	2	

		20CA2002 - Data Structures and Algorithms Lab	0.6	1.8	1.8	1.4	1.8	0.6	1.4	1.8	0.6	1.4	1.8	1.8	1.8	1
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Academic Year 2020 - 2021 - Semester – II - Btch 2021 - 2023 - List of Electives 2020R

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO	PSO	PSO2	
												10	11	12			
															1		
I	V	16C A5201 - PHP Programming	2.8	0	0	0.8	0	2.8	0.8	0	2.8	0.8	0	0	0	0	1.8
		16CA5202 - Python Programming	3	3	3	2.8	3	0	2.8	0	0	0	0	0	0	3	1.2
		16CA5001 PHP Programming Lab	3	3	3	3	3	0	3	3	0	0	0	0	2	3	2.2
		16CA5002 Python Programming Lab	3	0	0	1	0	3	1	0	3	1	0	0	0	0	2

Academic Year 2020 - 2021 - Semester – V - List of Electives - Batch (2018 - 2021)

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO	PSO	PSO2	
												10	11	12			
															1		
III	Elective List sem V	16CA5301 _ Big Data Analytics	2.4	0.4	0.4	1.2	0.4	2.4	1.2	0.4	2.4	2.4	1.2	0.4	0.4	0.4	2.2
		16CA5303 Cloud Computing	2.2	0.6	0.6	1.4	0.6	2.2	1.4	0.6	2.2	2.2	1.4	0.6	0.6	0.6	2.4
		16CA5304 Mobile Computing	2.0	0.7	0.7	0.8	0.3	2.0	0.8	0.3	2.0	2.0	0.8	0.3	0.3	0.3	1.8
		16CA5305 - Semantic Web Services	3.0	3.0	2.4	3.0	1.8	3.0	3.0	2.4	3.0	3.0	3.0	2.4	2.4	2.4	3.0
		16CA5306 - Security in Computing	1.8	1.4	1.4	1.4	1.4	1.8	1.4	1.4	1.4	1.8	1.4	1.4	1.4	1.4	1.6
		16CA5307 - Web Graphics	3	3	2.4	3	1.8	3	3	2.4	3	3	3	2.4	2.4	2.4	3
		16CA5308 Middleware Technologies	2.2	0.6	0.6	1	0.6	2.2	1	0.6	2.2	2.2	1	0.6	0.6	0.6	1.6
		16CA5309 - Management Information System	1.8	1.0	1.0	1.0	0.3	1.8	1.0	0.3	1.8	1.8	1.0	0.3	0.3	0.3	1.6
		16CA5310 - E-Commerce	2.4	0.2	0.2	0.8	0.2	2.4	0.8	0.2	2.4	2.4	0.8	0.2	0.2	0.2	1.8

		16CA5311 Professional Ethics	1.2	1.75	1.75	1.2	1	1.2	1.2	1	1.2	1.2	1	1	1	1.4
		16CA5312 - Human Resorce Management	1.8	1.0	1.0	1.0	0.3	1.8	1.0	0.3	1.8	1.0	0.3	0.3	0.3	1.6

Academic Year 2020 - 2021 - Semester – V - Open Electives - Batch (2018 - 2021)

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	PO	PO	PSO	PSO2
												10	11	12		
															1	
III	Opem Elective	16CAX4XX - Network Security	1.8	1	1	1.4	0.8	1.8	1.4	0.8	1.8	1.4	0.8	0.8	0.8	2
		16CAX4XX - Fundamentals of Cloud Computing	2.2	0.6	0.6	1.4	0.6	2.2	1.4	0.6	2.2	1.4	0.6	0.6	0.6	2.4



BoS Chairman



Dean Academics