

**Rashtreeya Sikshana Samithi Trust**

# **R.V. COLLEGE OF ENGINEERING**

**(Autonomous Institution, Affiliated to VTU, Belagavi)**

**R.V. Vidyaniketan Post, Mysuru Road,**

**Bengaluru - 560 059**



**Master of Computer Applications (M.C.A)**

**Scheme and Syllabus**

**Scheme 2016**

## **R.V. College of Engineering, Bengaluru – 59**

*(Autonomous Institution Affiliated to VTU, Belagavi)*

### **Department of Master of Computer Applications**

#### **Vision**

Pioneering in ICT Enabled Quality Education and Research with a focus on Sustainable and Inclusive Applications

#### **Mission**

- To adapt novel methodologies for quality education through experiential learning
- To empower students with continuous, holistic education, emphasizing on discipline, ethics and social commitment
- To become a vibrant knowledge center for research and software development
- To continuously build capacity steering towards industry- institute collaborative research and entrepreneurial competencies
- To utilize and develop free and open source software tools for sustainable and inclusive growth

#### **Program Educational Objectives (PEO)**

MCA graduates will be able to

**PEO1:** Practice software engineering principles and standards to develop software to meet customer requirements across verticals

**PEO2:** Contribute to build sustainable and inclusive applications using mathematical, simulation and meta-heuristic models

**PEO3:** Demonstrate entrepreneurial qualities through individual competence and teamwork

**PEO4:** Achieve successful professional career with integrity and societal commitments leading to lifelong learning

#### **Program Outcomes (PO)**

MCA graduates will be able to:

**PO1: Computational Knowledge:** Acquire in-depth computational knowledge and mathematics with an ability to abstract and conceptualise models from defined problems and

requirements.

- PO2: Problem Analysis:** Identify, formulate, conduct literature survey and solve complex computing problems through analysis as well as provide optimal solutions.
- PO3: Design / Development of Solutions:** Design and evaluate solutions for complex problems, components or processes that meet specified needs after considering public health and safety, cultural, societal, and environmental factors.
- PO4: Conduct investigations of complex Computing problems:** Conduct literature survey to analyse and extract information relevant to unfamiliar problems and synthesise information to provide valid conclusions and interpret data by applying appropriate research methods, tools and design experiments.
- PO5: Modern Tool Usage:** Create, select, adapt and apply appropriate techniques, resources and modern IT tools to complex computing system activities, with an understanding of the limitations.
- PO6: Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
- PO7: Life-long Learning:** Engage in lifelong learning independently for continual development to improve knowledge and competence as a computing professional
- PO8: Project management and finance:** Demonstrate knowledge and understanding of management principles and apply these to multidisciplinary software development as a team member and manage projects efficiently as a leader considering economical and financial factors
- PO9: Communication Efficacy:** Understand and communicate effectively with the computing community and with society at large, regarding complex computing systems activities confidently and effectively by writing effective reports and design documentations by adhering to appropriate standards, make effective presentations and give / receive clear instructions
- PO10: Societal and Environmental Concern:** Understand responsibilities and consequences based on societal, environmental, health, safety, legal and cultural issues within local and global contexts relevant to professional computing practices.

**PO11: Individual and Team Work:** Function effectively as an individual, as a member or leader in diverse teams in multidisciplinary environments.

**PO12: Innovation and Entrepreneurship:** Identify a timely opportunity for entrepreneurship and use innovation to pursue and create value addition for the betterment of the individual and society at large.

### **Program Specific Criteria**

**The MCA programme will enable the students, by the time they graduate to**

**PSC1:** Explain the principles of mathematics, computing and business foundations

**PSC2:** Demonstrate the use of software tools and technologies relevant to various verticals

**PSC3:** Design and develop software products, processes and systems for real world situations

### **Program Specific Outcomes (PSO)**

**MCA graduates will be able to:**

**PSO1:** Solve real world computing system problems of various industries by understanding and applying the principles of mathematics, computing techniques and business concepts

**PSO2:** Design, test, develop and maintain desktop, web, mobile and cross platform software applications using modern tools and technologies

## Scheme and Syllabus

<b>First Semester</b>								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA11	Data Structures (Theory and Practice)	MCA	4	0	1	0	5
2	16MCA12	Operating Systems (Theory and Practice)	MCA	4	0	1	0	5
3	16MCA13	Web Technologies (Theory and Practice)	MCA	3	0	1	1*	5
4	16MCA14	Computer Organization and Architecture	MCA	4	0	0	1*	5
5	16MAT15	Discrete Mathematics	MAT	4	1	0	0	5
		<b>Total</b>		<b>19</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>25</b>
		Contact (Hrs/ week)		19	1	6	0	26
		Non-Contact(Hrs/week)*		0	1	0	8	09
<b>Second Semester</b>								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA21	Database Systems (Theory and Practice)	MCA	4	0	1	0	5
2	16MCA22	Object Oriented Programming (Theory and Practice)	MCA	4	0	1	0	5
3	16MCA23	Analysis and Design of Algorithms (Theory and Practice)	MCA	4	0	1	0	5
4	16MCA24	Software Engineering	MCA	3	1	0	1*	5
5	16MCA25	Management Information System and E-Commerce	MCA	4	0	0	1*	5
		<b>Total</b>		<b>19</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>25</b>
		Contact (Hrs/ week)		19	1	6	0	26
		Non-Contact (Hrs/week) *		0	1	0	8	--

Third Semester								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA31	Computer Networks (Theory and Practice)	MCA	4	0	1	0	5
2	16MCA32	Software Testing and Practices (Theory and Practice)	MCA	4	0	1	0	5
3	16MCA33X	Elective-1 (Theory and Practice)	MCA	4	0	1	0	5
4	16MCA34X	Elective-2	MCA	4	0	0	1*	5
5	16MCA35	Research Methodology	MCA	3	0	0	1*	4
		<b>Total</b>		<b>19</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>24</b>
		Contact (Hrs/ week)		19	0	6	0	25
		Non-Contact (Hrs/week)*		0	0	0	8	--
Elective 1 Theory + Practice								
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Title
16MCA331	Content Management System	16MCA332	Advanced Object Oriented Programming	16MCA333	Model view controller Programming			
Elective 2								
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Title
16MCA341	System Programming	16MCA342	Advanced Database Systems	16MCA343	Operations Research			

Fourth Semester								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA41	Enterprise Application Programming (Theory and Practice )	MCA	4	0	1	0	5
2	16MCA42X	Elective-3 (Theory and Practice )	MCA	4	0	1	0	5
3	16MCA43X	Elective-4	MCA	4	0	0	1*	5
4	16MCA44	Software Project Management	MCA	3	1	0	1*	5
5	16MCA45	Business Communication	MCA	3	0	0	0	3
6	16MCA46	Minor Project-1	MCA	0	0	5	0	5
		<b>Total</b>		<b>18</b>	<b>1</b>	<b>7</b>	<b>2*</b>	<b>28</b>
		Contact(Hrs/week)		18	1	9	0	28
		Non-Contact (Hrs/week)*		0	1	5	8	13
Elective 3 Theory + Practice								
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Title
16MCA421	Advanced Computer Networks	16MCA422	Mobile Application Development	16MCA423	Computer Graphics			
Elective 4								
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Title
16MCA431	Network Security	16MCA432	Information Retrieval	16MCA433	Modeling and Simulation			

Fifth Semester								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA51	Data Analytics (Theory and Practice)	MCA	4	0	1	0	5
2	16MCA52X	Elective - 5 (Theory and Practice)	MCA	4	0	1	0	5
3	16MCA53X	Elective – 6	MCA	4	0	0	0	4
4	16MCA54X	Elective – 7	MCA	4	0	0	0	4
5	16MCA55	Minor Project II	MCA	0	0	5	0	5
		<b>Total</b>		<b>16</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>23</b>
		Contact(Hrs / week)		16	0	9	0	25

Elective 5					
Theory + Practice					
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
16MCA521	Cloud Computing	16MCA522	Virtual Reality	16MCA523	Internet of Things
Elective 6					
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
16MCA531	Distributed and Parallel Computing	16MCA532	Service Oriented Architecture	16MCA533	Data warehousing & Data Mining
Elective 7					
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
16MCA541	Wireless and Mobile Networks	16MCA542	Principles of UI / UX Design	16MCA543	Soft Computing



Sixth Semester								
Sl. No	Course Code	Course Title	BoS	Credit Allocation				Total Credits
				Lecture L	Tutorial T	Practical P	Self study S	
1	16MCA61	Major Project	MCA	-	-	23	-	23
2	16MCA62	Seminar	MCA	-	-	02	-	02
<b>Total</b>				<b>0</b>	<b>0</b>	<b>25</b>	<b>0</b>	<b>25</b>

**Total number of credits required to be earned by students**

Program	Normal Duration Years (Semesters)	Total No. of credits to be Earned (Average/Semester=25)
PG Degree MCA	Three (3) Years or Six Semesters	150
PG Degree MCA (Lateral Entry)	Two(2) Years or Four Semesters	100

**Credit distribution in the MCA program**

Category	Min Credits	Max Credits	Credits to be earned for 2016 Scheme
Core (incl.soft core)	40	70	82
Elective	20	35	33
Seminar	02	10	02
Industrial Internship & Project Work	20	35	33
<b>Total</b>			<b>150</b>

## I Semester

<b>Data Structures</b> (Theory & Practice)			
<b>Course Code</b>	<b>:</b>	<b>16MCA11</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand the fundamental techniques of Abstract Data Types			
2. Implement different data structures like stacks, queues, linked lists, trees and graphs			
3. Recognize different data structures and its applications			
4. Solve problems by using data structures for different applications			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Data Structures</b>			
Data Structures and Arrays in C, Implementing Structures and Union, Pointers, Scope of Variables Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Arrays and Stacks</b>			
Dynamically Allocated Arrays, Sparse Matrices, Representation of Multidimensional Arrays, Stacks, Stacks using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks			
<b>Unit – III</b>			<b>09 Hrs</b>
<b>Queues and Linked lists</b>			
Queues, Circular Queues, Single- and Double-Ended Priority Queues, Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Doubly Linked Lists			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Trees</b>			
Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps, Binary Search Trees, Selection Trees, Forests, Counting Binary Trees			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>Graphs and Sorting</b>			
The Graph Abstract Data Type, Graphs: Definitions, Applications of graphs, Representation of graphs, Bubble sort, Selection Sort, Merge sort, Tree sorting: Binary Tree sort, Heap Sort			
<b>Unit – VI (Lab Component)</b>			
<b>Part – A</b>			
<b>Implement the following programs using C Language.</b>			
1. Implement a menu driven program to search using -			
a. Linear Search   b. Binary Search			

2. Write a menu driven program to sort the given number of elements (using random number generation) using
  - a. Bubble Sort
  - b. Selection sort
3. Write a program to implement operations for a String based Stack
4. Write a program to implement basic queue operations
5. Simulate the working of circular queue providing the following operations
  - a. Insert
  - b. Delete
  - c. Display
6. Simulate the working of a singly linked list providing the following operations
  - a. Insert at the beginning
  - b. Insert at the end
  - c. Insert at the position
  - d. Display
7. Simulate working of a singly circular linked list providing the following operations
  - a. Delete from the beginning
  - b. Delete every alternate element
  - c. Display and Insert is Mandatory
8. Create a binary search tree and implement tree traversal

#### Part – B

1. Demonstrate a program to implement Recursion
2. Parse Infix arithmetic expressions to postfix arithmetic expressions.
3. Demonstrate how a computer system evaluates an Expression.
4. Demonstrate a program to print the jobs waiting in a queue assigning priority to the jobs.
5. Write a program to generate the rank list of a student using dynamic memory allocation.
6. Simulate an undo operation using doubly linked list.
7. Perform Depth Wise Traversal of a graph.

Note: Students are required to implement all the programs in Part–A and Part–B

#### Course Outcomes

After going through this course the student will be able to

**CO1:** Discuss data abstraction and data structures such as stacks, queues, lists, trees and graphs

**CO2:** Identify relevant data structures to develop solutions for a problem

**CO3:** Examine the use of data structures in relevant applications

**CO4:** Evaluate different data structures to solve real world problem

#### Reference Books

1	Horowitz, Sahni and Anderson-Freed, "Fundamentals of Data Structures in C", 2 <sup>nd</sup> Edition, University Press, 2007, ISBN: 0-929306-40-6. ISBN: 978-0-929306-40-7
2	Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tannenbaum, "Data Structures Using C and C++", 2006, PHI, ISBN 10: 0130369977, ISBN 13: 9780130369970
3	Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach with C", 2005, Thomson, ISBN-13: 978-0-534-39080-8
4	Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", 2 <sup>nd</sup> Edition, PHI Publications, ISBN-10: 0131103628 ISBN-13: 978-0131103627

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	L	M	-	L	-	-	-	L	-
CO2	H	H	M	M	M	-	L	-	L	-	-	-
CO3	H	H	H	M	H	-	L	L	-	-	-	-
CO4	H	H	H	H	H	-	L	-	-	-	-	-

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	L
CO2	H	H
CO3	H	H
CO4	H	H

**H-High, M-Medium, L-Low**

## I Semester

<b>Operating Systems</b> (Theory & Practice)			
<b>Course Code</b>	<b>:</b>	<b>16MCA12</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L: T: P: S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Identify the concepts, principles and services of operating system			
2. Understand the operating system functionalities managing with hardware			
3. Analyze the structure and design decisions involved in the implementation of an operating System			
4. Explore various operating system utility commands to manage operating system			
5. Implement various operating system algorithms			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Operating Systems</b>			
Operating system objectives and functions, evolution of operating systems, Unix – architecture, features, file system; Basic file attributes, filters – head, tail, cut, paste, tr, grep			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Process Management</b>			
Process, Process States, Process Description, Process Control, CPU Scheduler and Scheduling Algorithms			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Concurrency Control</b>			
Principles of Concurrency, Semaphore, Message Passing, Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Dining Philosopher's problem using semaphores			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Memory Management</b>			
Swapping, Contiguous Memory Allocation, Paging, Segmentation, Demand Paging, Page Replacement and Allocation of Frames			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>File and Disk Management</b>			
File Sharing, Protection, Directory Implementation, Allocation Methods, Free Space Management, Disk Structure, Disk Scheduling and Disk Management			
<b>Unit – VI (Lab Component)</b>			

**Part – A**

1. a) Create a file under a three-level file hierarchy structure and change file into read only file and display the username, size of the file and modification date.  
b) Convert the last or first 4 lines of a file into uppercase and store in another file.  
c) Display the row in the calendar which contains the date in which a specified file was created and convert the date value to \*.
2. a) Display corresponding home directory of a login name or current login.  
b) Display the users in the current working directory along with user and group identifiers  
c) Display all the System information – operating system, kernel etc.
3. Write a C program to mimic – grep command to search pattern, and its occurrence
4. Write a C program to mimic – cp command.
5. Given the list of processes, their CPU burst times and priority, compute and display the average waiting time and average turnaround time using Priority Scheduling.
6. Write a C program to simulate the MFT (Multiprogramming with Fixed number of tasks) memory management technique.
7. Write a C program to implement FCFS disk scheduling algorithm.

**Part – B**

1. Write a shell script to display the current user/any other user details with CPU and Memory utilization.
2. Write a shell script to implement Secured Terminal Login.
3. Write a script to search for file details in a directory (including subdirectory) which is having maximum and minimum memory size.
4. Write a Script to list the users who have logged in and logged out on a specified date and check for users currently logged in from the list.

**Course Outcomes**

After going through this course the student will be able to

**CO1:** Illustrate the fundamentals of operating system components and demonstrate its functionalities using UNIX commands

**CO2:** Summarize the operating system resources and its management techniques

**CO3:** Apply the different management techniques to handle the basic operating system resources

**CO4:** Analyze upon the different algorithms in managing the computer resources

**Reference Books**

1	William Stallings, “Operating Systems – Internals and Design Principles”, Pearson, 7 <sup>th</sup> Edition, 2012, ISBN:978-93-325-1880-3
2	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts” , John Wiley, 8 <sup>th</sup> Edition, 2010, ISBN :978-81-265-205-0
3	Sumitabha Das, “Unix Concepts and Applications”, Mc Graw Hill, 4 <sup>th</sup> Edition, 2012, ISBN:978-0-07-063546-3
4	P. Chakraborty, “Operating Systems”, Jaico Publishing House, 1 <sup>st</sup> Edition, 2011, ISBN 9788179929766

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment.

Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed.

**Change of program is not permitted.**

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed.

**Change of program is not permitted.**

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	L	L	M	L	L	L	-	L	-	L
CO2	M	M	L	L	L	-	M	-	-	L	-	-
CO3	H	M	-	L	M	L	-	-	-	-	-	-
CO4	H	H	-	L	M	L	-	-	-	-	-	-

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	L
CO2	M	L
CO3	H	M
CO4	H	M

**H-High, M-Medium, L-Low**

**I Semester****Web Technologies  
(Theory and Practice)**

<b>Course Code</b>	<b>: 16MCA13</b>	<b>CIE Marks</b>	<b>: 100+50</b>
<b>Hrs/Week</b>	<b>: L: T: P: S 3:0:2:4</b>	<b>SEE Marks</b>	<b>: 100+50</b>
<b>Credits</b>	<b>: 5</b>	<b>SEE Duration</b>	<b>: 3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Explain the technologies used in web applications.			
2. Demonstrate HTML5, CSS, JavaScript coding for web applications			
3. Design creative websites using object based scripting concepts			
4. Analyze dynamic HTML and XML integration with DOM			
<b>Unit – I</b>			<b>07 Hrs</b>
<b>Introduction to Web Technologies</b>			
Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. Multi-tier Application Architecture, Client-Side Scripting versus Server-Side Scripting, HTML and HTML5. Markup Language (HTML5): HTML5 tags - Formatting, Commenting, Code, Anchors, Backgrounds, Images, Hyper-links, Lists, Tables, Frames HTML Forms.			
<b>Unit – II</b>			<b>07 Hrs</b>
<b>Front End Design</b>			
Cascading Style Sheet (CSS): Introduction to CSS – Basic syntax and structure, In-line Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, manipulating text, Margins and Padding, Positioning using CSS. XML: Introduction, syntax, Document structure, Document Type Definitions, Namespaces, XML schema, displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets			
<b>Unit – III</b>			<b>08 Hrs</b>
<b>Basics of JavaScript</b>			
Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions.			
<b>Unit – IV</b>			<b>08 Hrs</b>
<b>JavaScript and HTML Documents</b>			
The JavaScript Execution Environment, The Document Object Model, Elements Access in JavaScript, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, Dom Tree Traversal and Modification.			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>Dynamic Documents with JavaScript</b>			
Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements.			
JavaScript Objects: Introduction Math Object, String Object, Fundamentals of Characters and Strings, Methods of the String Object, Character-Processing Methods Searching Methods, Date Object, Boolean and Number Objects Document Object			



**Unit – VI (Lab Component)****PART – A**

1. Create an HTML5 page to demonstrate the usage of
  - a. Text Formatting tags,
  - b. Links
  - c. Images
  - d. Tables
2. Create a web page with all types of Cascading style sheets.
3. Develop and demonstrate a HTML5 file that includes JavaScript script for the following
  - a. Input: A number n obtained using prompt  
Output: The first n Fibonacci numbers
  - b. Input: A number n obtained using prompt  
Output: A table of numbers from 1 to n and their squares using alert
4. Develop and demonstrate, using JavaScript script, a HTML5 document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

**PART – B**

1. Create WebPages using HTML5 and CSS for Employee Management Portal. The pages should have the following, but not limited to:
  - a. Proper headings
  - b. Links for more details
  - c. Images where ever appropriate
  - d. Provision to take feedback from the user
2. Design the static web pages required for an on-line book store web site.
  - a. Home Page
  - b. The static home page must contain three frames
  - c. Top frame: Logo and the college name and links to Home page, Login page, Registration page,
  - d. Left frame: At least four links for navigation, which will display the catalog of respective links.
  - e. For e.g.: When you click the link “MCA” the catalog for MCA
  - f. Books should be displayed in the Right frame.
  - g. Right frame: The pages to the links in the left frame must be loaded here. Initially this page contains description of the web site

3. Demonstrate a HTML5 and JavaScript functions for the following problems:
- Parameter: A string  
Output: The position in the string of the left-most vowel
  - Parameter: A number  
Output: The number with its digits in the reverse order
4. Demonstrate Java Script for different dialog box options.
5. Demonstrate a login page using HTML5 and validate the username and password using JavaScript.

### Self-Study Component

Topics on latest / emerging technologies will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by a expert panel in two phases appointed by the Director, MCA.

### Course Outcomes

After going through this course the student will be able to:

**CO1:** Interpret mark-up and scripting language concepts and demonstrate their applications

**CO2:** Apply the concepts of dynamic documents using DOM and JavaScript

**CO3:** Examine appropriate content layout design and event handling techniques

**CO4:** Implement web documents using HTML5, CSS, JavaScript and XML

### Reference Books

1	Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, 4th Edition, 2012. ISBN: 9788131724170
2	M. Srinivasan, "Web Technology Theory and Practice", Pearson Education, 1 <sup>st</sup> Edition, 2012, ISBN: 9788131774199
3	Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", Pearson Education, 5 <sup>th</sup> Edition, 2011, ISBN: 9780132151009
4	Chris Bates, "Web Programming Building Internet Applications", Wiley India, 3 <sup>rd</sup> Edition, 2006, ISBN: 9780470017753

### Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Continuous Internal Evaluation (CIE) for Practical

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment.

Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed.

Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	H	M	M	M	H	M	M	M
CO2	M	H	H	H	M	L	L	L	L	L	M	L
CO3	M	H	H	H	L	L	M	M	L	L	M	L
CO4	L	H	H	H	L	L	L	L	L	L	M	L

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	H
CO2	L	H
CO3	M	H
CO4	L	H

**H-High, M-Medium, L-Low**

## I Semester

<b>Computer Organization and Architecture</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA14</b>	<b>CIE Marks</b> : <b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L: T: P: S 4:0:0:4</b>	<b>SEE Marks</b> : <b>100</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Describe various data representations and explain how arithmetic and logical operations are performed by computers			
2. Explain the basic operation and relationship between the different components of computer.			
3. Understand the advanced architecture of microprocessors			
4. Write assembly programs for 8086 microprocessors			
<b>Unit – I</b>			<b>09 Hrs</b>
<b>Number Systems and Boolean Algebra</b>			
Number systems, Logic gates: The AND Gate, The OR gate, the inverter and Buffer, The NAND gate, the NOR Gate, the exclusive OR gate, The Exclusive NOR Gates, The NAND Gate as a universal Gate, Gates with More than two inputs, Using Inverters to convert gates. Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Combinational Logic and Sequential Logic</b>			
Expression simplification: The map Method, Two and Three – Variable Maps, four – Variables Map, Product of Sums Simplification, NAND and NOR Implementation, Don't Care Conditions. Adders, Subtractors, Binary Parallel Adder, Decimal Adder, Decoders, Multiplexers. Introduction to sequential logic: Flip – Flops, Triggering of Flip- Flops			
<b>Unit – III</b>			<b>09 Hrs</b>
<b>Basic Structure of Computer and Machine Instructions</b>			
Computer Types, Functional Units, Basic Operational Concepts, Bus structures, Performance, Memory Location and Addresses Machine Instruction and Programmers, Memory Operations, Instructions & Instruction Sequencing, Basic Input/output Operations. Introduction to Microprocessor based computer system			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>8086 Architecture</b>			
Introduction, Architecture of 8086 Microprocessor, Pin functions, Minimum / Maximum mode of operation			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>8086 Programming</b>			
8086 instruction sets, addressing modes, Assembler directives, Programming examples			
<b>Self-Study Component</b>			
Topics on latest / emerging technologies relevant to the course will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by a expert panel in two phases appointed by the Director, MCA.			

**Course Outcomes**

After going through this course the student will be able to:

**CO1:** Illustrate the concepts of Digital system, its organization and architecture.

**CO2:** Apply the basic concepts of Digital system and Assembly language in solving problems.

**CO3:** Analyze the working of Digital Logic circuits and Assembly language programs.

**CO4:** Justify the solutions selected for a problem.

**Reference Books**

1	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education Limited, 2016, ISBN-13 9789332542525.
2	Carl Hamacher, Z Varnesic and S Zaky, "Computer Organization", Tata McGraw Hill Publishing Co.Ltd, 5 <sup>th</sup> Edition, 2002 ISBN-13 9781259005275.
3	Yu-Cheng Liu & Glenn A Gibson, "Microcomputer systems 8086/8088 family, Architecture, Programming and Design", Pearson Education Limited, 2 <sup>nd</sup> Edition, 2003, ISBN-9788120304093.
4	Douglas V Hall, "Microprocessors and Interfacing", McGraw Hill, 2 <sup>nd</sup> Edition, 2010, ISBN-13 9780070601673.

**Scheme of Continuous Internal Examination (CIE)**

CIE will consist of Two Tests, Two Quizzes and Self study. The test will be for 30 marks each, quiz and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M	-	L	-	M	M	L	-	L	-
CO2	H	M	M	-	M	-	L	L	L	-	L	-
CO3	M	L	M	L	L	-	L	L	L	-	-	-
CO4	L	-	M	L	L	-	L	L	L	-	-	-

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	M
CO2	M	M
CO3	L	M
CO4	L	L

**H-High, M-Medium, L-Low**

## I Semester

<b>Discrete Mathematics</b>					
<b>Course Code</b>	:	<b>16MAT15</b>	<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L-T-P-S: 4-2-0-0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>5</b>	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Identify and explain the basic concepts of set theory, counting techniques and induction to perform computational operations.					
2. Illustrate formal methods of symbolic logic and proof techniques used to solve traditional computing problem.					
3. Analyze the concepts of relations and their properties used in computer applications.					
4. Demonstrate the proper use of function notation and Identify the most appropriate model based both on technology and the context of the situation.					
5. Use graph theoretic models to solve some basic problems in informatics.					
<b>Unit – I</b>					<b>10 Hrs</b>
<b>Set Theory and Counting</b>					
Sets and subsets, set operations and the laws of set theory, Venn diagrams, Principle of inclusion-exclusion, The rules of sum and product, Permutations and Combinations, Mathematical induction.					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Logic</b>					
Propositional logic: Connectives, Truth table, Tautology, Contradiction, Logical equivalence, Logical implications, Laws of Logic, Rules of Inference, Quantifiers, Methods of Proof.					
<b>Unit – III</b>					<b>09 Hrs</b>
<b>Relations</b>					
Cartesian product and relations, Computer recognition: zero-one matrices and directed graphs Properties of relations, Equivalence relations, Posets and Hasse diagrams.					
<b>Unit – IV</b>					<b>09 Hrs</b>
<b>Functions</b>					
Functions: plain and one-to-one, onto functions, Stirling numbers of the second kind, Composition and inverse functions, Special functions.					
<b>Unit – V</b>					<b>10 Hrs</b>
<b>Graphs</b>					
Definition of graph, basic concepts in graph theory, vertex degree, Sub graphs, Complement and graph isomorphism, Euler trails and circuits, Hamilton paths and cycles, Planar graphs, Graph coloring and chromatic polynomials.					
<b>Course Outcomes</b>					
After going through this course the student shall be able to					
<b>CO1:</b> Identify and interpret the fundamental concepts of discrete structures.					
<b>CO2:</b> Apply the knowledge and skills obtained to examine and solve different types of Computational problems.					
<b>CO3:</b> Analyze mathematical concepts like sets, reasoning, relational algebra and graph theory to solve the problems and optimize the solution.					

<b>CO4:</b> Distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems arising in practical situations.												
<b>Reference Books</b>												
1	Ralph P Grimaldi, B.V.Ramana, “Discrete and Combinatorial Mathematics”, An applied introduction, 5 <sup>th</sup> Edition, Pearson Education, 2007, ISBN-10: 8177584243, ISBN-13:9788177584240											
2	Kenneth H Rosen, "Discrete Mathematics & its Applications", 7 <sup>th</sup> Edition, McGraw-Hill, 2010, ISBN-10: 0073383090, ISBN-13: 9780073383095											
3	D.S. Malik & M.K Sen, “Discrete Mathematical Structures: Theory & Applications”, Course Technology, 2004, ISBN 10: 0619212853, ISBN 13: 9780619212858											
4	Geir Agnarsson & Raymond Greenlaw, ”Graph Theory-Modeling, Applications and Algorithms”, Pearson Education, 2008, ISBN - 978-81-317-1728-8											
<b>Scheme of Continuous Internal Evaluation (CIE):</b> CIE will consist of Two tests, Two quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.												
<b>Scheme of Semester End Examination (SEE):</b> The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions student must answer five questions from each unit. The questions will have internal choice with maximum of 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.												
<b>Mapping of Course Outcome to Program Outcome</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	M	-	L	L	-	L	-	L	-	-	-
<b>CO2</b>	H	M	L	M	-	-	L	-	-	-	-	-
<b>CO3</b>	M	H	L	M	-	-	L	-	-	-	-	-
<b>CO4</b>	H	H		M	L	-	L	-	-	-	-	-
<b>Mapping of Course Outcome to Program Specific Outcome</b>												
	<b>PSO1</b>						<b>PSO2</b>					
<b>CO1</b>	M						L					
<b>CO2</b>	L						L					
<b>CO3</b>	M						H					
<b>CO4</b>	L						M					
<b>H-High, M-Medium, L-Low</b>												

## II Semester

<b>Database Systems (Theory &amp; Practice)</b>			
<b>Course Code</b>	: 16MCA21	<b>CIE Marks</b>	: 100+50
<b>Hrs/Week</b>	: L:T:P:S 4:0:2:0	<b>SEE Marks</b>	: 100+50
<b>Credits</b>	: 5	<b>SEE Duration</b>	: 3 Hrs
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Explain database concepts and structures and terms related to database design, transactions and management			
2. Demonstrate data modeling, normalization and development of the database			
3. Formulate SQL statements for data definition, modification and retrieval of data			
4. Analyze how databases are affected by real-world transactions			
5. Design and build a simple database system			
<b>Unit – I</b>			<b>08 Hrs</b>
<b>Basic Concepts</b>			
Introduction to data, information, databases, database management system; Characteristics of database approach, Actors on the Scene, Advantages of using DBMS approach, Classification of Database Applications, Data models, Schema and instances, Three schema architecture and independence, DBMS Environment, Client/ Server Architectures of DBMS, E-R Model – E-R Diagrams			
<b>Unit – II</b>			<b>08 Hrs</b>
<b>Data Models and Basic SQL</b>			
Introduction to Data Models, Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Keys, Dealing with Constraint Violations, E-R to Relational Mapping, Advantages of SQL, Data Definition Language and Data Types			
<b>Unit – III</b>			<b>09 Hrs</b>
<b>Structured Query Language</b>			
Data Manipulation language, Data Control Language, Data Query Language and all related commands. Queries using Group by and Order by clause & Join, Operators, Aggregate Functions, Commit, Rollback, Save point. Views: Introduction			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Database Design Theory and Normalization</b>			
Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multi-valued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>Transaction Processing and Concurrency Control</b>			
Introduction-Properties of Transaction, Serializability, Concurrency Control, Locking Mechanisms, Two Phase Commit Protocol, Dead lock			



**Unit – VI (Lab Component)****PART- A**

1. Consider the scenario of a hospital system.  
Patients are treated in a single ward by the doctors assigned to them. Usually each patient will be assigned a single doctor, but in rare cases they will have two. Health care assistants also attend to the patients; a few these are associated with each ward. Initially the system will be concerned solely with drug treatment. Each patient is required to take a variety of drugs a certain number of times per day and for varying lengths of time. The system must record details concerning patient treatment and staff payment. Some staff is paid part time and doctors and care assistants work varying amounts of overtime at varying rates (subject to grade). The system will also need to track what treatments are required for which patients and when and it should calculate the cost of treatment per week for each patient.
  - a. Identify super key, candidate keys, primary keys, Referential Integrity
  - b. Explain the cardinality and participation between entities in the problem
  - c. Create an ER diagram and the schema relationship for the above scenario Create the relations
  - d. Design and execute queries for listing out
    - The patients examined by a doctor
    - Healthcare assistants of a ward
    - Cost of treatment per week by a patient
    - Availability of doctors based on specialization during emergency
2. Design and develop a database for Employee management system and perform the following task.
  - a. Retrieve the names of all employees who do not have supervisors
  - b. Retrieve the names of all employees whose surname is same as their supervisors
  - c. Retrieve the name of each employee who has a dependent with the same first name as the employee
  - d. Retrieve the name of each employee who works on all the projects controlled by department number 5
  - e. Retrieve the names of employees who have no dependents
3. Design and develop a database for order processing system in a company. Perform the following queries
  - a. Retrieve custname, No. of orders, Avg\_order\_amount, where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer.
  - b. List the order no for orders that were shipped from all the warehouses that the company has in a specific city.
  - c. Retrieve the details of customers who have placed maximum number of orders.
  - d. Retrieve the customer name and city that have placed least order amount.
  - e. Demonstrate the deletion of an item from the database and demonstrate a method of handling the rows in the table that contains the order placed on the deleted item

4. Design and develop a University database which tracks information about Departments, Professors, Students, Project Assistants and Projects. Perform the following Queries and ensure to grant permissions for specified users to view the contents (create views and grant permission over the view)
  - a. Retrieve the names of all professors who do not have an ongoing project of more than 1 lakhs
  - b. Retrieve the names of all graduate students along with their senior graduate student and the professors under whom they work
  - c. List the professors and the sum of their total budgeted projects

### PART-B

1. Create a GUI for each of the above scenarios and demonstrate CRUD operations
2. Backup and Restore Databases and tables
3. Using ODBC/JDBC, connect to the RDBMS and demonstrate CRUD operations

### Course Outcomes

After going through this course the student will be able to:

**CO1:** Explain the basic concepts of data models, database design for transaction processing and Query Language

**CO2:** Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram

**CO3:** Transform high-level conceptual model to relational data model, populate database and formulate queries based on principles of normalization

**CO4:** Design and Implement a Database for any given problem

### Reference Books

- |   |   |
|---|---|
| 1 | Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Addison Wesley, 6 <sup>th</sup> Edition, 2011, ISBN 13: 978-0-136-08620-8 |
| 2 | Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database Systems Concepts", McGraw-Hill Education, 6 <sup>th</sup> Edition, 2010, ISBN 0-07-352332-1 |
| 3 | Raghu Ramakrishnan, Johannes Gehrke, "Database Management System", Mc Graw-Hill, 3 <sup>rd</sup> Edition, 2003, ISBN-10: 0072465638                       |
| 4 | Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden, "Modern Database Management", Prentice Hall, 8 <sup>th</sup> Edition, ISBN-13: 978-0-13-033969-0   |

### Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Continuous Internal Evaluation (CIE) for Practical

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. In test, the Part B can be executed for the data set created during execution of Part A.

Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed. The Part B can be executed for the data set created during execution of Part A.

Change of program is not permitted.

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	M	L	M	M	L	L	L	L
CO2	H	H	M	M	L	-	M	M	L	-	-	-
CO3	H	H	M	M	L	L	L	L	L	-	-	-
CO4	H	H	M	L	L	-	M	M	M	-	L	L

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	H	M
CO2	M	M
CO3	H	H
CO4	H	H

**H-High, M-Medium, L-Low**

## II Semester

<b>Object Oriented Programming (Theory &amp; Practice)</b>			
<b>Course Code</b>	: <b>16MCA22</b>	<b>CIE Marks</b>	: <b>100+50</b>
<b>Hrs/Week</b>	: <b>L: T: P: S 4:0:2:0</b>	<b>SEE Marks</b>	: <b>100+50</b>
<b>Credits</b>	: <b>5</b>	<b>SEE Duration</b>	: <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
<ol style="list-style-type: none"> <li>1. Develop an understanding of the essential principles in object oriented programming</li> <li>2. Implement object oriented programming concepts using Python programming language</li> <li>3. Incorporate design patterns standards for solving a real-world problem</li> <li>4. Utilize object based approaches during software development</li> </ol>			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Foundations of Object Oriented Concepts</b>			
History of object oriented languages: structured programming, procedural programming Abstract data types, encapsulation, Typed and untyped languages Coupling and cohesion Concepts Encapsulation, Classes and objects, Class members: Data members (fields) and member functions (methods), Class member visibility (private, public, protected), Class variables and instance variables, Class methods and instance methods, Service methods and support methods, Scope Class hierarchies, Single and multiple inheritance, Inter-class relationships, Constructor and Destructor, Object initialization, Memory management, Garbage collection, Methods and messages, Method signatures, Method and operator overloading, Method overriding.			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Design Principles</b>			
Abstract classes, Dynamic (late) binding, Polymorphism, Software reuse, Super classes (base classes), Subclasses (derived classes), Invocation of superclass methods and constructors, Objects vs variables, Classes vs types, Delegation, Collection classes, Class libraries.			
Unified Modeling Language (UML), Use case diagrams: actors, system boundary, <<uses>> and <<extends>>, Scenarios, Class diagrams: associations, aggregation, dependency, and inheritance, Object interaction diagrams, object state transition diagrams.			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Design Patterns</b>			
Design patterns, Pattern documentation: structure, participants and consequences, Types of patterns: Creation Patterns-Singleton, Abstract Factory, Behavior Patterns-Command, State, Structural Patterns-Adapter, MVC, Façade.			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Introduction to Python Programming Language</b>			
Fundamentals of Python Programming language: Variables, Operators, Functions, Modules, Conditional Structure and Recursive functions, Iterations, Data types in python: Numeric, Sequences (String, List and Tuple), Sets and Mapping (Dictionary).			

<b>Unit – V</b>		<b>09 Hrs</b>
<b>Object oriented programming using Python</b> Classes and Objects, functions, methods, Inheritance, polymorphism and Exception handling		
<b>Unit – VI (Lab Component)</b>		
<b>Part – A</b>		
<ol style="list-style-type: none"> <li>1. Write a python script to demonstrate searching technique (linear or binary)</li> <li>2. Write a python script to demonstrate sorting (Bubble or Selection or Insertion or Quick)</li> <li>3. Write a python program demonstrating polymorphism (operator and function)</li> <li>4. Write a python program to demonstrate Inheritance and exception handling</li> <li>5. Write a python program demonstrating 10 operations using python datatypes (any one)               <ol style="list-style-type: none"> <li>a) String b) List c) Tuple d) Sets and e) Dictionary</li> </ol> </li> </ol>		
<b>Part – B</b>		
Students will be given problem statements to implement any of the following design patterns using Use Case Diagram and Class Diagrams		
<ol style="list-style-type: none"> <li>1. <b>Facade</b> (Structural Pattern)</li> <li>2. <b>Model View Control</b> (Structural Pattern)</li> <li>3. <b>Command</b> (Behavior Pattern)</li> <li>4. <b>State Pattern</b> (Behavior Pattern)</li> <li>5. <b>Abstract Factory</b> (Creation Pattern)</li> <li>6. <b>Singleton</b> (Creation Pattern)</li> </ol>		
<b>Course Outcomes</b>		
After going through this course the student will be able to:		
<b>CO1:</b> Relate and recall object oriented and structured programming concepts		
<b>CO2:</b> Demonstrate competency in object oriented concepts		
<b>CO3:</b> Utilize object oriented concepts and develop solutions using python programming language		
<b>CO4:</b> Examine UML design patterns and analyze design solutions using python programming language		
<b>Reference Books</b>		
1	Martin Fowler, “UML Distilled”, Addison Wesley, 3 <sup>rd</sup> Edition, 2003, ISBN: 0321193687, 978-0321193681	
2	Chetan Giridhar, “Learning Python Design Patterns”, Packet Publishing, 2 <sup>nd</sup> Edition, 2016, ISBN: 978-1783283378	
3	Allen Downey, Jeffrey Elker, Chris Meyers, “Learning with Python”, Dreamtech press, 2013, ISBN 13: 978-9351198147	

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment.

Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have internal choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks. Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	-	-	-	L	-	-	-	-	-	-
CO2	H	M	L	-	M	L	L	-	-	-	-	-
CO3	H	M	M	L	H	M	L	-	-	-	-	-
CO4	H	M	H	L	H	L	L	-	-	-	-	-

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	L
CO2	L	H
CO3	H	M
CO4	L	H

**H-High, M-Medium, L-Low**

## II Semester

<b>Analysis and Design of Algorithms</b> (Theory & Practice)			
<b>Course Code</b>	: 16MCA23	<b>CIE Marks</b>	: 100+50
<b>Hrs/Week</b>	: L:T:P:S 4:0:2:0	<b>SEE Marks</b>	: 100+50
<b>Credits</b>	: 5	<b>SEE Duration</b>	: 3 Hrs
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand the need of different Algorithm techniques			
2. Apply mathematical preliminaries to the analysis and design stages of different types of algorithms,			
3. Analyze the algorithms based on time and space complexity			
4. Understand and develop a variety of techniques for designing algorithms both on uni- and Multi-processor technology			
5. Develop new or re-use already existing efficient algorithms to solve problems			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Algorithms &amp; Divide and Conquer technique</b>			
Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Introduction to divide and conquer, Merge Sort, Quick Sort and its performance			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Decrease and Conquer &amp; Greedy Method</b>			
Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim’s Algorithm, Kruskal’s Algorithm; Single Source Shortest Paths			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Dynamic Programming &amp; Coping with Limitations of Algorithmic Power</b>			
Warshall’s Algorithm, Floyd’s Algorithm for the All-Pairs Shortest Paths Problem, Single-Source , Shortest Paths: 0/1 Knapsack, The Traveling Salesperson problem			
<b>Unit – IV</b>			<b>08 Hrs</b>
<b>Space and Time Trade Offs and Limitations of Algorithmic Power</b>			
Space-Time Tradeoffs: Introduction, sorting by Counting, Input Enhancement in String Matching, Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>Backtracking and Branch - Bound Technique</b>			
Backtracking: n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem, Branch and Bound-Assignment Problem, Travelling Salesman Problem, Approximation Approaches-Nearest Neighbor, Twice Around the Tree			
<b>Unit – VI (Lab Component)</b>			
Design, develop and implement the specified algorithms for the following problems using C/C++, Students are required to execute all the programs in Part-A and Part B, and show the demonstration in the lab			

**Part – A**

1. Implement Quick sort and analyze its time complexity using different values of n (n is the number of inputs) and represent the complexity in a graph sheet, The input should be generated randomly
2. Print all the nodes reachable from a given starting node in a digraph using BFS method
3. Check whether a given graph is connected or not using DFS method
4. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm,
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and determine the time taken to find the minimum cost
7. Compute the transitive closure of a given directed graph using Warshall's algorithm
8. Implement 0/1 Knapsack problem using Dynamic Programming
9. Find a subset of a given set  $S = \{s_1, s_2, s_n\}$  of n positive integers whose sum is equal to a given positive integer d, For example, if  $S = \{1, 2, 5, 6, 8\}$  and  $d = 9$  there are two solutions  $\{1,2,6\}$  and  $\{1,8\}$ , A suitable message is to be displayed if the given problem instance doesn't have a solution
10. Implement N Queen's problem using Back Tracking

**Part – B**

1. The time complexity of bubble sort is  $O(n^2)$ , Suggest the improvements to be made in the algorithm so that the efficiency of the algorithm is improved
2. Apply Divide and Conquer method to sort a given set of elements using Merge Sort and determine the time required to sort the elements, The elements can be read from a file or can be generated using the random number generator
3. Implement Dynamic programming to find solution to Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm, Determine the error in the approximation
4. Apply dynamic Programming to find the Shortest Path in a network among all the nodes,
5. Apply Decrease and Conquer Technique to topological order the vertices in a given digraph

**Course Outcomes**

After going through this course the student will be able to

- CO1:** Identify paradigms and approaches used in algorithms and appreciate the impact of algorithm design in practice
- CO2:** Classify different computational models (e.g., divide-and-conquer), order notation and various complexity measures (e.g., running time, disk space) to analyze the complexity/performance of different algorithms
- CO3:** Implement and apply various techniques for efficient algorithm design (divide-and-conquer, greedy, and dynamic algorithms)
- CO4:** Analyze and evaluate different algorithm techniques for a real-life application and find the optimal solution using various parameters

**Reference Books**

- |   |   |
|---|---|
| 1 | Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Person Education, 3 <sup>rd</sup> Edition, 2016, ISBN-13: 9780321358288 |
|---|---|



2	Ellis Horowitz, Sanguthevar Rajasekaran, Sartaj Sahni, “Fundamentals of Computer Algorithms”, Galgotia, 2 <sup>nd</sup> Edition, 2004, ISBN 13: 9788175152571
3	Rod Stephens, “Essential Algorithms- A Practical Approach to Computer Algorithms”, Wiley, 2013, ISBN: 978-1-118-61210-1
4	Rajesh K, Shukla, “Analysis and Design of Algorithms A Beginner’s Approach”, Wiley Edition: 2015, ISBN 13: 9788126554775

#### **Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments, The test will be for 30 marks each, quiz and assignment for 10 marks each, The total marks for CIE (Theory) will be 100 marks

#### **Scheme of Continuous Internal Evaluation (CIE) for Practical**

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Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B must be executed. Change of program is not permitted

#### **Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.

#### **Scheme of Semester End Examination (SEE) for Practical**

SEE for the practical will be based on writing proper program, execution and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Part A weightage will be 70% and Part B weightage will be 30% of 40 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

#### **Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	-	L	-	L	M	-	-	-	-
CO2	H	H	M	M	H	-	-	M	-	-	L	L
CO3	H	L	L	L	-	-	L	-	-	-	L	-
CO4	M	M	H	M	-	L	-	-	-	-	-	-

#### **Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	H	L
CO2	L	H
CO3	M	H
CO4	H	M

**H-High, M-Medium, L-Low**

## II Semester

<b>Software Engineering</b>			
<b>Course Code</b>	: 16MCA24	<b>CIE Marks</b>	: 100
<b>Hrs/Week</b>	: L: T: P: S 3:2:0:4	<b>SEE Marks</b>	: 100
<b>Credits</b>	: 5	<b>SEE Duration</b>	: 3 Hrs
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Demonstrate the basic concepts of Software Engineering, phases of software development Life cycle, Concept of professional ethics using various system models			
2. Illustrate various testing techniques and Software advancement methods to build Quality Software products			
3. Discover advanced concepts in Software Engineering for effective Software Development			
4. Assess Project management strategies to meet change in customer requirements			
<b>Unit – I</b>			<b>08 Hrs</b>
<b>Introduction &amp; Software Process Models</b>			
Introduction: Professional Software Development, Software engineering and the Web, IEEE/ ACM code of software engineering ethics, Case studies; Software Process models: waterfall, incremental development, Process activities: Coping with change, Plan-driven and agile Development, Extreme Programming, Scrum			
<b>Unit – II</b>			<b>07 Hrs</b>
<b>System Modeling, Architectural Design and implementation</b>			
System Modeling: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering; Architectural Design: Architectural design decisions, Architectural views, Architectural patterns			
<b>Unit – III</b>			<b>07Hrs</b>
<b>Software Testing &amp; Evolution</b>			
Software Testing: Development testing, Test driven development, Release testing, User testing; Software Evolution: Evolution processes, Legacy systems, Software maintenance			
<b>Unit – IV</b>			<b>07 Hrs</b>
<b>Advanced Software Engineering</b>			
Component-based Software Engineering: Components and component models, CBSE processes, Component composition; Distributed Software Engineering: Distributed systems, Client–server computing, Software as a service			
<b>Unit – V</b>			<b>07 Hrs</b>
<b>Software Management</b>			
Project management: Risk management, managing people, Teamwork; Project planning: Plan driven development, Project scheduling, Estimation techniques			
<b>Self Study Component</b>			
Topics on latest / emerging technologies will be assigned, Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken, The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA,			

<b>Tutorial Component</b>												
Students are required to make the team of 4 to 5 members, Each team has to do role play (For Eg: customer, Analyst, Developer, tester & Manager) and exhibit different stages of various software life cycle models												
<b>Expected Course Outcomes</b>												
After going through this course the student will be able to												
<b>CO1:</b> Interpret the basic concepts of Software Engineering, professional ethics and Demonstrate the phases of software development Life cycle using various system models.												
<b>CO2:</b> Compare various testing techniques and relate Software advancement methods to build Quality Software products.												
<b>CO3:</b> Analyze and Apply emerging software engineering concepts and methods for construction of Software systems.												
<b>CO4:</b> Evaluate project management strategies for effective software development.												
<b>Reference Books</b>												
1	Ian Sommerville, “Software Engineering”, Pearson Education Ltd, 10 <sup>th</sup> Edition, 2015, ISBN: 9780133943030											
2	Roger S Pressman, “Software Engineering- A Practitioner’s Approach”, McGraw-Hill, 8 <sup>th</sup> Edition, 2015, ISBN: 978-0078022128											
3	Pankaj Jalote, “Software Engineering”, Wiley India Pvt, Ltd, 3 <sup>rd</sup> Edition, 2011, ISBN: 9788126523115											
4	Bernd Bruegge & Allen H, Dutoit, “Object-oriented Software Engineering: Using UML, Patterns and Java”, Pearson Education Ltd, 3 <sup>rd</sup> Edition, 2010, ISBN: 9780136066811											
<b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b>												
CIE will consist of Two tests, Two quizzes and self study. The test will be for 30 marks each, quiz for 10 marks each and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks.												
<b>Scheme of Semester End Examination (SEE) for Theory</b>												
The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions by selecting one from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.												
<b>Mapping of Course Outcome to Program Outcome</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	M	M	M	M	M	H	M	L	H	M	M	-
<b>CO2</b>	M	M	M	M	M	L	M	M	M	L	M	M
<b>CO3</b>	M	H	M	M	M	L	M	M	M	M	M	L
<b>CO4</b>	M	M	L	M	L	M	M	H	M	L	M	M
<b>Mapping of Course Outcome to Program Specific Outcome</b>												
	<b>PSO1</b>						<b>PSO2</b>					
<b>CO1</b>	M						M					
<b>CO2</b>	M						H					
<b>CO3</b>	M						H					
<b>CO4</b>	H						M					
<b>H-High, M-Medium, L-Low</b>												

## II Semester

<b>Management Information Systems &amp; E-Commerce</b>			
<b>Course Code</b>	:	<b>16MCA25</b>	<b>CIE Marks</b> : <b>100</b>
<b>Hrs/Week</b>	:	<b>L: T: P: S 4:0:0:4</b>	<b>SEE Marks</b> : <b>100</b>
<b>Credits</b>	:	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Demonstrate the basic working principles of information systems and enterprises			
2. Make use of preliminaries of technologies and apply in business information systems and Decision support systems			
3. Appraise students with the Business applications and eCommerce initiatives			
4. Elaborate the importance of management challenges in IT sector			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Information Systems in Business</b>			
The Real World of Information Systems, The Fundamental Roles of Information Systems, Internet and Business, Globalization and Information Technology, Business Process Reengineering, Fundamentals of Information Systems – Introduction, Components of an Information System, Types of Information Systems, Recognizing Information Systems ( 2 Case studies)			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Computer Hardware and Software</b>			
Computer Hardware – Trends in Computer Systems, Storage Trends and Trade Offs; Computer Software – Software Suites and Integrated Packages, Programming Packages; Business Telecommunication – Networking the Enterprise, Managing Organizational Change, Global Business and IT Strategies, Business Use of Internet; Database Management - Managerial Considerations for Data Resource Management (2 Case studies)			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Information Systems for Business, eCommerce and Enterprise Collaboration</b>			
Information Systems in Business, Enterprise Resource Planning: The Business Backbone; Foundations of eCommerce, Business-to-Consumer eCommerce, Business-to-Business eCommerce, Online Transaction Processing, Enterprise Collaboration, Groupware for Enterprise Collaboration, (2 Case studies)			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Information Systems for Decision Support, Strategic Advantages</b>			
Introduction, Decision Support Systems (DSS), Using DSS, Executive Information Systems; Competitive Strategy Concepts, Strategic roles of Information Systems, Challenges of Strategic Information systems, Sustaining strategic success (2 Case studies)			
<b>Unit – V</b>			<b>09 Hrs</b>
<b>Management Security Challenges &amp; Controls</b>			
Organization and Information Technology, Security and Ethical Challenges: Information systems controls, its need, Audit information systems, Ethical dimensions, Computer Crime, Societal solutions, you and ethical responsibility (2 Case studies)			

<b>Self-Study Component</b>												
Topics on latest / emerging technologies will be assigned, Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken, Self-study is reviewed and evaluated in two phases by an expert panel, appointed by Director, MCA,												
<b>Course Outcomes</b>												
After going through this course the student will be able to												
<b>CO1:</b> Illustrate the fundamentals of a computer based information systems and enterprises												
<b>CO2:</b> Distinguish the preliminaries of technologies and Experiment with business information systems and Decision support systems												
<b>CO3:</b> Apply E-Commerce initiatives in various Business applications												
<b>CO4:</b> Perceive the significance of Managerial strategies and challenges in IT sector												
<b>Reference Books</b>												
1	James A O'Brien and George M Marakas, "Management Information Systems", Tata McGraw Hill, 10th Edition, 2008, ISBN -13: 978-1-25-902671-3, ISBN-10: 1-25-902671-X											
2	Kenneth C, Laudon, Jane P, Laudon, "Management of Information Systems", Pearson, Dorling Kindersley(India) Pvt, Ltd, 12th edition, 2013, ISBN 9780132142854											
3	Waman S Jhawadekar, "Management Information Systems", Tata McGraw Hill, 4 <sup>th</sup> Edition Edition, 2009, ISBN : 9780070146624											
4	Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce: Fundamentals and Applications", John Wiley & Sons, 2003, ISBN: 9780471493037											
<b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b>												
CIE will consist of Two tests, two Quizzes and Self study. The test will be for 30 marks each, quiz for 10 marks each and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks.												
<b>Scheme of Semester End Examination (SEE) for Theory</b>												
The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions by selecting one from each unit. The questions will have internal choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.												
<b>Mapping of Course Outcome to Program Outcome</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	M	M	M	M	M	L	M	H	M	M	M	M
<b>CO2</b>	M	M	M	H	M	M	M	H	M	M	M	M
<b>CO3</b>	M	M	M	H	M	L	M	H	M	M	M	L
<b>CO4</b>	H	M	M	M	L	M	M	H	H	M	M	M
<b>Mapping of Course Outcome to Program Specific Outcome</b>												
	<b>PSO1</b>						<b>PSO2</b>					
<b>CO1</b>	H						M					
<b>CO2</b>	M						H					
<b>CO3</b>	M						M					
<b>CO4</b>	M						M					
<b>H-High, M-Medium, L-Low</b>												

### III Semester

<b>Computer Networks (Theory and Practice)</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA31</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
<ol style="list-style-type: none"> <li>1. Understand the fundamental concepts of computer networks</li> <li>2. Familiarize with the design issues and protocols of various layers</li> <li>3. Recognize the application of different algorithms to solve design issues</li> <li>4. Analyze various layering protocols in computer networks</li> </ol>			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction-</b> Introduction, Uses of Computer Networks, Network Hardware, Network Software, Reference Models, Example Networks			
<b>Physical Layer-</b> Guided Transmission Media, Digital Modulation and Multiplexing			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Data Link Layer-</b> Data link Layer Design issues, Error Detection and Correction, Sliding Window Protocols			
<b>Medium Access Control-</b> The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Broadband Wireless, Bluetooth, Data Link Layer Switching			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>The Network Layer-</b> Network Layer Design issues, Routing algorithms- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Routing for Mobile Host, Congestion Control Algorithms, Quality of Service, Internetworking, The Network Layer in the Internet			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>The Transport Layer-</b> The Transport Service, Elements of Transport Protocols, Congestion Control, Internet transport protocols- TCP, UDP, Performance issues			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>The Application Layer-</b> The Domain Name System, Electronic Mail, The World-Wide-Web, Streaming Audio and Video			
<b>Unit – VI (Lab Component)</b>			
<b>Part – A</b>			
<ol style="list-style-type: none"> <li>1. Create a LAN with five nodes implementing star topology in it. Demonstrate class full Addressing in it.</li> <li>2. Create a bridge and demonstrate tunneling using open VPN.</li> <li>3. Demonstrate routing with NAT and iptables.</li> <li>4. Compare file transfer with wired and wireless networks.</li> <li>5. Build a DNS and DHCP server using dns-masq.</li> </ol>			

**Part – B**

1. Write a program to demonstrate TCP echo server and client (using C / Python)
2. Create a IPV6 network with the help of dns-masq.
3. Build a firewall using iptable to drop private network on public interface, to block / allow ICMP request.
4. Create a LAN using Virtual Machine and install FTP server to demonstrate file transfer.
5. Consider a network with two computers (PC1, PC2) connected to ISP through a gateway. A DHCP server also has to be configured as part of the network to assign IP address dynamically. Perform the following tasks on the network.
  - a) Establish the physical connection among the host
  - b) Assign IP Address dynamically
  - c) Check TCP/IP configuration
  - d) Test the connectivity
  - e) ping the loopback IP address
  - f) Display the ARP table

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1:** Identify the design issues, services, interfaces, protocols and flow of data in computer networks

**CO2:** Analyze the elements and protocols for peer - peer and communication between layers

**CO3:** Implement the protocols and services designed for physical, data link, network and transport layers

**CO4:** Evaluate the principles and protocols in computer networking

**Reference Books**

- |   |   |
|---|---|
| 1 | Andrew S. Tanenbaum, David J Wetherall, “Computer Networks”, Pearson Education, Pearson Publication, 5 <sup>th</sup> Edition, 2012, ISBN-1978-81-317-8757-1 |
| 2 | Behrouz A Forouzan, Firouz Mosharraf, “Computer Networks A Top-Down Approach”, Tata McGraw-Hill Education Pvt. Ltd, 2011, ISBN 13: 9781259001567            |

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

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CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage of Part A is 70% and Part B weightage is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	H	L	M	L	-	-	-	-	-	M	-	L
CO2	M	H	L	L	-	-	L	-	M	-	M	-
CO3	M	L	H	L	-	L	-	L	L	L	-	L
CO4	H	M	L	L	-	-	-	M	L	M	L	-

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	H	M
CO2	M	M
CO3	H	L
CO4	M	H

**H-High, M-Medium, L-Low**



### III Semester

<b>Software Testing and Practices (Theory and Practice)</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA32</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand the basics of Software Testing			
2. Recognize various types of Software Testing Techniques			
3. Analyze various levels of software testing			
4. Explore software test automation process			
<b>Unit – I</b>			<b>09 Hrs</b>
<b>Basics of software testing</b> - Basic Definitions, Test Cases, Insights from a Venn Diagram, Identifying Test Cases, Fault Taxonomies, Levels of Testing; Examples: Generalized Pseudocode, The Triangle Problem, The NextDate Function, The Commission Problem, The SATM System			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Boundary value testing, Equivalence class testing, Decision table based testing</b> -Normal, Robust and Worst-case Boundary value testing, special value testing, Examples, Random testing, Traditional and Improved Equivalence class testing, Equivalence class test cases for triangle problem, NextDate function and commission problem, Decision tables, Decision Table Techniques, Decision Table Test cases for triangle problem			
<b>Unit – III</b>			<b>10Hrs</b>
<b>Path Testing, Data flow testing, Life Cycle–Based Testing</b> -Program Graphs, DD Paths, Test coverage metrics, Basis path testing, Define/Use Testing, Slice-Based Testing, Program Slicing Tools, Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing, Agile Model–Driven Development			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Integration Testing, System testing</b> -Decomposition-Based Integration, Path-Based Integration, Example: integration NextDate; Threads, Basis Concepts for Requirements Specification, Model-Based Threads, Use Case–Based Threads, Coverage Metrics for System Testing, Nonfunctional System Testing, Atomic System Function Testing Example			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>Test Management and Automation</b> -Preparing a Test Plan, Scope Management, Deciding Test Approach, Setting up Criteria for testing; Test Automation and terms used, Skills needed for Automation, Scope of Automation, Process Model for Automation, Selecting a Test tool, Challenges in Automation			
<b>Introduction to Selenium</b> - Overview and working with Selenium IDE, Selenium Web Driver			
<b>Unit – VI (Lab Component)</b>			

**Part – A****Design and write a program using Python to implement the following**

1. Solve Triangle problem and analyze it from the perspective of decision table-based testing. Develop various test cases, execute them and discuss the test result
2. Solve Next date problem and analyze it from the perspective of boundary value testing. Generate test cases to test the method that increment the date, the method that increments the month and the method that increments the year. Execute the test cases and discuss test results
3. Write and execute test cases from the perspective of equivalence class testing for the application whose input box accepts numbers between 1-100. Valid range 1-100, Invalid range 0 or less and 101 or more. Also ensure that text field permits only numeric characters
4. Solve the commission problem to compute the commission based on the sales of total number of locks, stocks and barrels sold for the following criteria:
  - i) if (sales $\geq$ 1800), commission=20%
  - ii) if (sales is between 1000 and 1800), commission=15%
  - iii) and if (sales $\leq$ 1000), commission=10%
 Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results
5. Implement the Binary search Algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results

**Part – B****Testing Case / Suite Implementation**

Pre-requisite: Students are required to design and develop a sample webpage in order to learn test automation process using Selenium

1. Write and execute test cases to test sign in page of a specific web Page
2. Write and execute test cases to identify the objects like combo box, text boxes, radio buttons in a webpage and display the count
3. Write and execute test cases to verify the passing criteria (Pass percentage 50% of total marks, 60%-69% for first class & 70 % -100% for distinction, Fail for 0%-49%) by importing 5 students' subjects' marks from Excel file and update the same in Excel file.
4. Develop and execute a test suite containing minimum 2 test cases for any web site
5. Write and execute test cases to read and validate the employee master data from a webpage which contains fields of types numeric, character and date and copy the same data and display on another webpage

**Note :Students are required to implement all the programs in Part-A and Part B**

**Course Outcomes**

After going through this course the students will be able to

**CO1:**Demonstrate the fundamentals of software testing using real world examples

**CO2:**Identify and apply relevant testing techniques suitable for a real world scenario

**CO3:**Investigate the different levels in testing

**CO4:** Implement Test Automation process and experiment with testing tools like Selenium or other open source tools

**Reference Books**

- |   |  |
|---|--|
| 1 | Paul C. Jorgensen, "Software Testing, A Craftsman's Approach", Auerbach Publications, 4 <sup>th</sup> Edition, First Indian Reprint, 2014, ISBN-13:9781466560680 |
| 2 | Srinivasan Desikan Gopaldaswamy, "Software Testing Principles and Practices", Pearson Education, 5 <sup>th</sup> Edition, 2008 , ISBN: 9788177581218             |

3	Unmesh Gunecha, “Learning Selenium Testing Tools with Python”, PACKT Publishing, 2014,ISBN: ISBN 9781783983506											
<p><b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b> CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.</p> <p><b>Scheme of Continuous Internal Evaluation (CIE) for Practical</b> CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.</p> <p><b>Scheme of Semester End Examination (SEE) for Theory</b> The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.</p> <p><b>Scheme of Semester End Examination (SEE) for Practical</b> The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage of Part A is 70% and Part B weightage is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.</p>												
<b>Mapping of Course Outcomes (CO) to Program Outcomes (PO)</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	L	L	L	M	L	-	M	M	H	M	H	-
<b>CO2</b>	M	H	L	H	L	-	M	H	M	H	M	L
<b>CO3</b>	M	L	-	-	-	-	L	-	M	L	M	-
<b>CO4</b>	L	L	-	M	H	-	M	L	L	M	L	L
<b>Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)</b>												
	<b>PSO1</b>						<b>PSO2</b>					
<b>CO1</b>	M						L					
<b>CO2</b>	H						M					
<b>CO3</b>	L						L					
<b>CO4</b>	M						H					
<b>H-High, M-Medium, L-Low</b>												

### III Semester

#### Elective – I Content Management System (Theory and Practice)

<b>Course Code</b>	:	<b>16MCA331</b>	<b>CIE Marks</b>	:	<b>100+50</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	:	<b>100+50</b>
<b>Credits</b>	:	<b>5</b>	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Distinguish between various content management systems capabilities					
2. Create and customize contents for web pages					
3. Create lists, views in drupal					
4. Identify appropriate plugins, modules and themes for an application					
5. Create websites using Wordpress and Drupal					
<b>Unit – I</b>					<b>08 Hrs</b>
What Content Management is (and isn't)?, Points of Comparison, Acquiring a CMS, The Content Management Team, CMS Feature Analysis, Content Modeling, Content Aggregation					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>First Post</b> -What Is WordPress?, Popularity of WordPress, Content and Conversation, Getting Started, Finishing Up					
<b>Code Overview</b> -downloading, directory and file structure, wordpress configuration, wp-content user playground					
<b>Working With Wordpress Locally</b> -Benefits of Working Locally, Tools for Component Administration, Configuration Details, Deploying Local Changes					
<b>Tour of Core</b> - What is in the Core?, Using the core as a Reference					
<b>Unit – III</b>					<b>10 Hrs</b>
<b>The Loop</b> - Understanding the Loop, Template Tags, Customizing the loop, Global variables					
<b>Data Management</b> - Database Schema, Table Details, Word Press Database Class, Direct Database Manipulation					
<b>Custom Post Types, Custom Taxonomies and Meta data</b> -Understanding Data in Word Press, Word Press Taxonomy, Building your own taxonomy, Meta data					
<b>Theme Development</b> -Why use a Theme? Installing a Theme, What is a Theme?					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Introduction to Drupal</b> -Content Management Systems, Creating Content					
<b>Creating and Managing Content</b> -Understanding the Basics, Creating Content in Drupal, Editing Content, Other Content Options, Deleting Content, Finding Content					
<b>Creating and Managing Users</b> - Users, Roles, and Permissions, User Accounts, Configuring User Account Settings, Creating Roles, Assigning Permissions, Creating User Accounts, User Generated Accounts					
<b>Taxonomy</b> -Taxonomy Overview, Creating Vocabularies, Assigning a Taxonomy Vocabulary to a Content Type, Selecting a Taxonomy Term when Creating Content, Creating Human- and					

Search-Engine-Friendly Lists, Assigning More Than One Vocabulary

**Creating Menus-** Ordering From the Menu, Adding an Item to a Menu, Creating a New Menu

**Installing Themes-** How a Drupal Theme Works, Finding a New Theme, Installing a Theme, The Administration Theme, Configuration Options

**Drupal Blocks-**Blocks, Blocks, and More Blocks, Making Blocks Appear on Pages, Finding the List of Available Blocks, Reassigning and Deactivating Blocks, Configuring Blocks, Using Blocks from Contributed Modules, Creating Custom Blocks

### Unit – V

10 Hrs

**Drupal Modules-**Contributed Modules, How to Download, Install, and Configure a Module, Configuring Modules and Setting Permissions, Enabling Other Modules, The Top Eleven Modules

**Enabling Interactive Capabilities-** Blogging, Forums, Polls

**Content Types-** The Basic Page and Article Content Types, Defining a Custom Content Type, Creating a Custom Content Type, Other Field Types

**Views:** Installing the Views Module, Creating Your First View

**Panels-**Available Layouts, Creating a Panel Page, Using the Flexible Layout Option, Adding Other Things to Panel Panes

**Administering Your Drupal Site-** Backing Up Your Site, Checking the Log Files, Status Report, Checking for Updates

### Unit – VI (Lab Component)

#### Part –A

- 1.a. Demonstrate extending drupal functionality by using and configuring ckeditor and imce contributed modules for rich text formatting, file and image uploading in Drupal
- 1.b. Create a basic page for the template shown below

Logo	Header Name
Home About Us Products Contact us	Content
Footer	

2. Create a new content type with the following fields usn, student\_name, semester(integer), branch, program,date of birth(date type), sex(radio button), hobbies(check boxes), height(float), resume(file), ug\_studied(term reference) with a suitable title for the content in drupal.
3. Create a news slider showing fields like program, date and venue using views. Also create a photo slider for showcasing photos of the past events in Drupal. Attach the news slider to the first side bar block and photo slider to the footer of the theme installed.
4. Create a navigation menu having titles About Us, Authorities, Administration, Academics, Examination and Departments in Word Press. The sub-menu are as follows:  
 About Us – Objectives, Students Enrolment, MoU and Rules, Infrastructure  
 Authorities – Principal, Vice Principal, Dean Academics, Dean Student affairs, Dean Infrastructure  
 Administration – Registrar, Controller of Examination, Finance Office, Heads of Department  
 Academics – Programs offered, Softskills

Examination – Results, Time table, syllabus copy

Departments – Architecture, Biotech, Civil, Computer Science, Electronics

- 5 .a. Demonstrate a user creation, assigning a role and give permission to certain content in Drupal
- b. Create main menu with titles for the following:

HOME

ABOUT US

DEPARTMENTS

|--DEPARTMENTS NAMES

|- CSE

|- About the departments

|- Achivements

|-Faculty

|-Placements

|-ISE

|-MCA

KEY EXECUTIVES

CONTACT US

### Part – B

1. Install and configure Webform module in Drupal. Create a form for collecting faculty information with fields like Name, education Qualification, date of joining, email id and research publications(National and International) and demonstrate report generation.
2. a. Demonstrate backup update and restore of drupal websites.  
b. Install drush and demonstrate drush commands to enable, disable, download modules and clearing caches
3. Enable and configure the following core module: Demonstrate its working with appropriate contents
  - a. Poll
  - b. Blog
  - c. Forum
4. Build a website using Wordpress for a Product Based Company. The pages should contain the following
  - a. Proper headings, Links for more details
  - b. Images where ever appropriate
  - c. Displaying types of products and their prices
  - d. Provision to take feedback from the user and Validate important fields
5. Build a website using drupal for a school. The pages should contain the following
  - a. Proper headings, Links for more details
  - b. Images where ever appropriate
  - c. Displaying the school curriculum
  - d. Provision to take feedback from the users and Validate important fields

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1** : Compare and contrast between various content management systems

**CO2** : Enable and configure interactive capabilities

**CO3** : Demonstrate critical thinking skills to design and create different contents

**CO4** : Design and create content management system based websites

**Reference Books**

1	Deane Barker, "Web Content Management: Systems, Features, and Best Practices", O'Reilly Media, Inc., 1 <sup>st</sup> Edition, 2016, ISBN 978-1-4919-0812-9
2	Todd Tomlinson, "Beginning Drupal 7", 1 <sup>st</sup> Edition, Apress Publishing Company, ISBN-13 (pbk): 978-1-4302-2859-2
3	Brad Williams, David Damstra, Hai Stern, "Professional WordPress: Design and Development", 3 <sup>rd</sup> Edition, 2015, Wrox Publications, ISBN: 978-1-118-98724-7

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment.

Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

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**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	L	M	-	L	L	L	-	-	M
CO2	M	M	M	L	M	-	L	L	L	-	-	L
CO3	M	M	H	L	H	L	L	L	L	-	-	M
CO4	H	H	H	L	H	L	M	L	L	-	L	H

**Mapping of Course Outcomes(CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	L	L
CO2	M	M
CO3	M	H
CO4	H	H

**H-High, M-Medium, L-Low**

### III Semester

#### Elective – I Advanced Object Oriented Programming (Theory and Practice)

<b>Course Code</b>	: 16MCA332	<b>CIE Marks</b>	: 100+50
<b>Hrs/Week</b>	: L:T:P:S 4:0:2:0	<b>SEE Marks</b>	: 100+50
<b>Credits</b>	: 5	<b>SEE Duration</b>	: 3 Hrs
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1.Explore the advanced concepts Decorators, Context managers and Generators			
2.Illustrate Magic methods, Metaclasses, class factories and Abstract classes			
3.Develop GUI and Web Programming including advanced OOP concepts			
4.Theme standard features of frameworks while developing desktop and web applications			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction</b> - Decorators- Understanding Decorators, Decorator Syntax, Where Decorators are used? Why you should write Decorators? When you should write Decorators? Writing Decorators, decorating classes, Context Managers- Context manager syntax, when you should write context managers? Generators- Understanding what a Generator is, Understanding Generators syntax, communication with generators, iterable vs iterators, generators in the standard library			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Magic Methods</b> - Magic method syntax, Available Methods			
<b>Metaclasses</b> -Classes and Objects, Writing Metaclasses, When to use Metaclasses			
<b>Class Factories</b> - Understanding a Class Factory Function, Determining when you should write class factories			
<b>Abstract Base classes</b> - Declaring a Virtual Subclasses, Declaring a Protocol, Built-in Abstract Base Classes			
<b>Reading and Writing Files</b> - What Kinds of Files are there?, Opening a File, Techniques for Reading Files, Writing Files, Notes to File Away			
<b>Unit – III</b>			<b>8 Hrs</b>
<b>GUI Programming: Tkinter</b> - Introduction, About Tcl, Tk, and Tkinter, Getting Tkinter Installed and Working, Client/Server Architecture –Tkinter and Python Programming, Tkinter Examples – Labels, Button widgets, Scale widgets, Partial Function Application			
<b>Unit – IV</b>			<b>10Hrs</b>
<b>Database Programming</b> - Introduction, Persistent Storage, Basic database operations and SQL, Databases and Python, Python DB API – Module Attributes, Connection Objects, Cursor Objects, Type Objects and Constructors, Relational Databases, Databases and Python- Adapters, Examples of using Database Adapters, Non-Relational Databases			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>Web Development</b> - Web Frameworks:Django- Introduction, Web Frameworks, Introduction to Django, Projects and Apps, “Your Hello World” Application (A Blog), Creating a model to add database service, Python Application Shell, Creating the Blog’s User Interface			
<b>Unit – VI (Lab Component)</b>			



**Part – A**

1. Write a program to create Fibonacci series using generators and stack the same with a decorator to find the time taken by the generator.
2. Demonstrate the following magic methods usage: i) `__getattr__` ii) `__setattr__`  
Example: Create a menu driven program for setting the attributes and getting the attributes from the class employee with attributes empno, name, designation, working status and display the same on screen. An appropriate message should be displayed if attribute is not present.
3. Write a Python program to demonstrate the Abstract Base Classes.  
Example: Create Animal class as abstract class and implement concrete sub classes cat, dog and cow from Animal class and demonstrate set, get and display methods.
4. Write a GUI application with username and password and a two buttons OK and Cancel. When the button is clicked, display appropriate message.
5. Write a python program to demonstrate connection to database and retrieve the information.  
Example: create menu driven program which will demonstrate add, display, modify and delete the record of an employee table created using database MYSQL with attributes slno, name, address, empcode, dateofbirth, age, mobile, status, designation
6. Write a python program to create a registration page for alumni meet for college and display the same in the next page using Django framework

**Part – B**

1. Write a program to create a back up of a given file. The program should prompt the user for the name of the file to copy and then write to a new file with the same content but with .bak as the file extension.
2. Demonstrate operator overloading using magic methods (addition, subtraction, multiplication and division)
3. Define meta classes to create new classes by re-implementing `__init__` and `__new__`  
Example: Create a class using `__init__` and `__new__` Also `__init__` method should display the memory allocation details and `__new__` method should display initialization of a class.
4. Demonstrate Conversion table with a Tkinter GUI
  - a) Metric Conversion (gram to ounce / kilo to pounds/ tonne to stone)
  - b) Temperature Conversion (Celsius to Fahrenheit)

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1:** Compare functions with decorators , context managers and generators

**CO2:** Demonstrate magic methods and meta classes for registering classes at creation time

**CO3:** Apply advanced Object Oriented Programming GUI development for Desktop and Web

**CO4:** Analyze the standard way of developing applications using a framework

**Reference Books**

1	Luke Sneeringer, “Professional Python”, Wrox, Wiley India Pvt ltd, 2016, ISBN:978-81-265-5895-7
2	Wesley J. Chun, “Core Python Application Programming”, 3 <sup>rd</sup> Edition, Pearson, 2016 ISBN:978-93-325-5536-5
3	Paul Gries, Jennifer Campbell, Jason Montojo, Edited by Lynn Beighley, “Practical Programming”, 2 <sup>nd</sup> Edition Reprint, The Pragmatic BookShelf, 2014, ISBN: 9781937785451, 1937785459

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

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CO1	L	L	L	-	M	-	L	-	-	-	-	-
CO2	-	L	M	M	M	-	L	-	-	-	-	-
CO3	-	M	M	M	H	-	M	M	-	-	M	M
CO4	-	H	M	-	H	M	M	-	M	-	M	M

**Mapping of Course Outcomes(CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	L	M
CO2	L	H
CO3	M	H
CO4	M	H

**H-High, M-Medium, L-Low**

## III Semester

<b>Elective – I</b>				
<b>Model View Controller Programming</b>				
<b>(Theory and Practice)</b>				
<b>Course Code</b>	<b>:</b>	<b>16MCA333</b>	<b>CIE Marks</b>	<b>:</b> <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	<b>:</b> <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b>	<b>:</b> <b>3 Hrs</b>
Course Learning Objectives (CLO)				
<b>Graduates shall be able to</b>				
1. Understand and use different Model View Controller design pattern techniques in various application areas				
2. Apply knowledge of frameworks in the development of Web application				
3. Analyze the performance of Web frameworks				
4. Develop MVC based applications using MEAN				
<b>Unit – I</b>				<b>09 Hrs</b>
<b>Introduction to MEAN (MongoDB, ExpressJS, AngularJS, NodeJS)</b>				
Three-tier web application development, Introduction to JavaScript and MEAN, Introduction to Node.js, JavaScript event-driven programming				
<b>Node.js</b> - event-driven programming, JavaScript closures Node modules, Common JS modules, Node.js core modules, Node.js third-party modules, Node.js file modules				
<b>Introduction to AngularJS</b> -Key concepts of AngularJS, the core module of AngularJS, The angular global object, AngularJS modules Two-way data binding				
<b>Unit – II</b>				<b>10 Hrs</b>
<b>Building Express Web Application</b> - Introduction to Express, Installing Express, Creating your first Express application, <b>The application, request and response objects</b> - The application object, The request object, The response object, External middleware,				
<b>Implementing the MVC pattern</b> -Application folder structure, Horizontal folder structure, Vertical folder structure, File-naming, conventions, Implementing the horizontal folder structure,				
<b>Configuring an Express application</b> -Environment configuration files Rendering views, Configuring the view system				
<b>Rendering EJS views</b> -Configuring the view system 71, Rendering EJS views				
<b>Unit – III</b>				<b>10 Hrs</b>
<b>Creating a MEAN CRUD Module</b>				
<b>Implementing the AngularJS MVC module</b> -Creating the AngularJS module service, Setting up the AngularJS module controller, Implementing the AngularJS module views, The create() method of the AngularJS controller, The find( ) and find One() methods of the AngularJS controller, The update() method of the AngularJS controller, The delete() method of the AngularJS controller				
<b>Implementing the AngularJS module views</b> - The create-article view, The view-article view, The edit-article view, The list-articles view				
<b>Unit – IV</b>				<b>09 Hrs</b>
<b>Introduction to MongoDB</b> - Introduction to NoSQL, Introducing MongoDB, MongoDB sharding,				
<b>MongoDB CRUD operations</b> -Creating a new document, Creating a document using insert(), Creating a document using update(), Creating a document using save()				
<b>Unit – V</b>				<b>10 Hrs</b>

**Introduction to Mongoose**-Introducing Mongoose ,Connecting to MongoDB, Understanding Mongoose schemas, Creating the user schema and model, Registering the User model, Creating new users using save(), Finding multiple user documents using find(), Reading a single user document using find One(), Updating an existing user document Deleting an existing user document, **Extending your Mongoose schema**- Defining default values, Using schema modifiers, Predefined modifiers, Custom setter modifiers, Custom getter modifiers

### Unit – VI (Lab Component)

#### Part – A

1. Create a model for a student information system with fields as USN, Name, sex, semester, branch, college, Aadhar card, passport number and bank acc no using Mongoose
2. Write a view for the above program with validations using JavaScript for blank fields, USN format, and name should contain only characters etc.
3. Write a Controller using AngularJS for the student information in Question number one and Two for Inserting, editing, deleting and updating the student information.
4. Create a model using mongoose with mongoose for employee information with fields as Empid, EmpName, Dept, designation, mobile number, email id using Aggregate model for sorting on Dept ID.
5. Create a view for the above program with validations using JavaScript for blank fields, USN format, name should contain only characters etc.
6. Create a Controller using ExpressJS for the employee information for the model in Question number four and view five for Inserting, editing, deleting and updating the employee information system.

#### Part – B

1. Create an Inventory Management system using Mean Stack Framework for tracking inventory levels, orders, sales and deliveries.
2. Create an Insurance Management system using Mean Stack Framework for handling all the key insurance functions like including product definition, handling of policies, and claims.
3. Develop and demonstrate online book carting system Mean Stack Framework provisions to create item list and customer to add items to the cart, alter the quantities of an item and remove items from the cart.
4. Create an Attendance management system using Mean Stack Framework for creating student's database and tracking student's attendance subject-wise and subject wise Attendance Report.

**Note : Students are required to implement all the programs in Part-A and Part B**

#### Course Outcomes

After going through this course the student will be able to

**CO1:** Understand the concepts of Model, view and controller

**CO2:** Apply Model, view and controller for developing applications using MEAN

**CO3:** Design Web entities for developing web applications using MEAN Frameworks

**CO4:** Implement MVC Framework for enterprise application

#### Reference Books

- |   |  |
|---|--|
| 1 | Amos Q. Haviv, "MEAN Web Development", PACKT Publication, 2014, ISBN 978-1-78398-328-5.                              |
| 2 | Simon Holmes, "Getting MEAN with Mongo, Express, Angular, and Node", MEAP Edition November 2015, ISBN 9781617292033. |

#### Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each,

quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

#### **Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

#### **Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

#### **Scheme of Semester End Evaluation (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage of Part A is 70% and Part B weightage is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

#### **Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	M	-	L	-	H	L	M	L	M	L	-	-
<b>CO2</b>	M	-	L	-	H	L	M	L	M	L	-	-
<b>CO3</b>	H	H	M	M	H	M	L	M	H	M	L	-
<b>CO4</b>	H	-	L	L	H	-	L	M	L	-	L	-

#### **Mapping of Course Outcomes(CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
<b>CO1</b>	M	M
<b>CO2</b>	M	M
<b>CO3</b>	H	H
<b>CO4</b>	H	H

**H-High, M-Medium, L-Low**

### III Semester

#### Elective – II System Programming

<b>Course Code</b>	<b>:</b>	<b>16MCA341</b>	<b>CIE Marks</b>	<b>:</b>	<b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:0:4</b>	<b>SEE Marks</b>	<b>:</b>	<b>100</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b>	<b>:</b>	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Explain the need of system software in executing application software					
2. Understand the different phases and data structures used in assembly process by an assembler					
3. Describe how the macros defined in assembly language will be processed					
4. Analyze the role of loaders and linkers in executing the programs with external references					
5. Summarize the concepts of system programming for Linux					
<b>Unit – I</b>					<b>09 Hrs</b>
<b>Introduction to System Software-</b> System Software, Goals of System software, System programs and system programming, Components of system software, Views of system software, Language Processing Activities, Fundamentals of Language Processing.					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Assemblers-</b> Elements of Assembly language programming. Simple assembler scheme, Pass Structure of an assembler, Design of single and two pass assembler. A single pass assembler for Intel X-86 Family processor					
<b>Unit – III</b>					<b>09 Hrs</b>
<b>Macro processors-</b> Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, design of Macro Preprocessor					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Linkers and Loaders-</b> Introduction, Relocation and linking concepts, Design of a Linker , Self Relocating Programs, Static and dynamic linking, Loaders. Software Development tools: Software tools for program development					
<b>Unit – V</b>					<b>10 Hrs</b>
<b>Essential concepts of Systems programming for Linux as Open Source OS-</b> Introduction and essential concepts of LINUX system programming: System Programming, APIs and ABIs standards, Program segments/sections; The ELF Format, Linking and loading, Linux dynamic libraries (shared objects), Multitasking and paging, Address translation, Memory Protection, Comparison with Windows					
<b>Self-Study Component-</b> Topics on latest / emerging technologies relevant to the course will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA.					

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1:** Understand the role of system software, Processor components & API standards in Software Execution

**CO2:** Apply the system software concepts and programming standards in software development

**CO3:** Analyse the importance of various data structures, algorithms and

**CO4:** Evaluate design options for structuring system software features

**Reference Books**

- |   |   |
|---|---|
| 1 | D. M. Dhamdhere, "Systems Programming", Tata McGraw Hill Publications, 2011, ISBN-13 978-0-07-133311-5                            |
| 2 | Robert Love, "Linux System Programming", O'Reilly Publications, 2 <sup>nd</sup> Edition, 2013 ISBN 978-1-449-33953-1              |
| 3 | Leland L. Beck, "System Software – An Introduction to Systems Programming", Pearson Education Asia, 3 <sup>rd</sup> Edition, 2000 |

**Scheme of Continuous Internal Evaluation (CIE)**

CIE will consist of Two Tests, Two Quizzes and Self study. The test will be for 30 marks each, quiz and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks

**Scheme of Semester End Examination (SEE)**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	L	L	-	M	L	-	M	-	L	-	M	L
<b>CO2</b>	L	L	-	L	L	-	L	-	L	-	M	L
<b>CO3</b>	L	M	L	L	L	-	L	-	L	-	L	L
<b>CO4</b>	L	L	L	M	L	-	M	-	L	-	M	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
<b>CO1</b>	M	L
<b>CO2</b>	M	L
<b>CO3</b>	M	L
<b>CO4</b>	L	L

**H-High, M-Medium, L-Low**

### III Semester

#### Elective – II Advanced Database Systems

<b>Course Code</b>	: <b>16MCA342</b>	<b>CIE Marks</b>	: <b>100</b>
<b>Hrs/Week</b>	: <b>L:T:P:S 4:0:0:4</b>	<b>SEE Marks</b>	: <b>100</b>
<b>Credits</b>	: <b>5</b>	<b>SEE Duration</b>	: <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Interface and interact with NoSQL			
2. Understand different storage architecture of NoSQL databases			
3. Perform Create, Read, Update, Delete (CRUD) operations			
4. Gain proficiency in NoSQL			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction and Exploring NOSQL- NOSQL</b> – Definition and Introduction, Sorted ordered Column – Oriented stores, Key/Value stores, Document databases, Graph Databases			
<b>Interfacing and Interacting with NOSQL</b> – If No SQL, then what?, Language Binding for NoSQL data stores			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Understanding the storage architecture</b> – Working with column- oriented databases, Document store internals, Understanding Key/Value stores			
<b>Performing CRUD Operations</b> – Creating Records, Accessing Data, Updating and Deleting Data			
<b>Querying NOSQL stores</b> – Similarities between SQL and MongoDB query features, Accessing data from Column-Oriented Database			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Modifying Data stores and Managing Evolution</b> – changing document databases, schema evolution in column oriented database			
<b>Indexing and Ordering Datasets</b> - Essential concepts behind a database index, indexing and ordering in MongoDB, creating and using indexes in MongoDB			
<b>Managing Transactions</b> - RDBMS and ACID , Distributed ACID, Upholding CAP, Consistency implementation			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Gaining proficiency with NOSQL</b>			
Using NOSQL in the CLOUD, Scalable Parallel Processing with Map Reduce, Analyzing Big Data with HIVE, Surveying Database Internals – MongoDB internals			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>Developing and Administration- PHP and MongoDB, Python and MongoDB, Creating Blog application with PHP Driver, Database Administration</b>			



**Self-Study Component**

Topics on latest / emerging technologies relevant to the course will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA.

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1** : Understand different types of NoSQL databases

**CO2**: Illustrate the different operations to manage data

**CO3**: Apply CRUD operations with MongoDB, Cassandra, CouchDB and Redis

**CO4**: Justify the need of NOSQL and choose appropriate NOSQL for a problem dealing with principles of CAP theory

**Reference Books:**

1	Shashank Tiwari, “Professional NOSQL”, Wiley India Private Limited, 2011, ISBN: 9978-8126-533-268
2	Membrey Peter, Plugge Eelco, Hawkins Tim, “The Definitive guide to MongoDB, The NOSQL Database for Cloud and Desktop Computing”, Apress2010, ISBN 978-1-4302-3052-6

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and self-study. The test will be for 30 marks each, quiz for 10 marks each and self-study for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions by selecting one from each unit. The questions will have internal choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.

**Mapping of Course Outcomes(CO) to Program Outcomes(PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
<b>CO1</b>	H	H	M	L	H	-	-	H	-	L	-	L
<b>CO2</b>	H	H	H	L	H	L	L	M	-	L	-	L
<b>CO3</b>	H	H	M	L	H	L	M	M	-	L	-	L
<b>CO4</b>	M	M	L	L	L	L	-	M	-	L	-	L

**Mapping of Course Outcomes(CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
<b>CO1</b>	H	H
<b>CO2</b>	H	H
<b>CO3</b>	H	M
<b>CO4</b>	M	L

**H –High, M-Medium, L-Low**

### III Semester

#### Elective – II Operations Research

<b>Course Code</b>	: 16MCA343	<b>CIE Marks</b>	: 100
<b>Hrs/Week</b>	: L:T:P:S 4:0:0:4	<b>SEE Marks</b>	: 100
<b>Credits</b>	: 5	<b>SEE Duration</b>	: 3 Hrs
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
<ol style="list-style-type: none"> <li>1. Understand the importance and applications of operations research in different domains</li> <li>2. Formulate the real world problems using mathematical models</li> <li>3. Identify different techniques to obtain optimal solution using OR models</li> <li>4. Explore and optimize Linear Programming Problem, Transportation problem, Assignment problems, network models, game theory and metaheuristics</li> <li>5. Explore practices to obtain good feasible solution using heuristic approach</li> </ol>			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Operations Research &amp; LPP</b> -Introduction, Operations Research models, Solving the OR models, Phases of an OR study, Two variable LP Model, Graphical LP Solution, The Simplex Method and Sensitivity Analysis- LP Model in equation form, Simplex Method, Artificial Starting Solution – M Method, Special cases in Simplex Method			
<b>Unit – II</b>			<b>10Hrs</b>
<b>Transportation and Assignment Problems</b> - Definition of Transportation Model, Transportation Algorithm - North-West Corner method, Least Cost Method, Vogel’s Approximation Method, Iterative Computations of the Transportation Algorithm, Assignment Model - Hungarian Method, Simplex explanation of the Hungarian Method.			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Network Models</b> - Scope and Definition of Network Models, CPM and PERT – Network representation, CPM computations, Construction of the Time schedule, PERT Networks			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Duality and Game Theory</b> -Definition of the Dual Problem, Primal dual relationship, Economic Interpretation of Duality, Dual Simplex Algorithm, Game Theory, Optimal Solution of Two person Zero Sum games, Solution of Mixed Strategy Games			
<b>Unit – V</b>			<b>8 Hrs</b>
<b>Non-Linear Programming –Metaheuristics</b>			
The Nature of Metaheuristics: Non-linear programming Problem, Traveling Salesman Problem - Sub Tour reversal algorithm, Tabu Search: Minimum spanning tree, Simulated Annealing: Traveling Salesman Problem, Genetic Algorithms: basic concept, Integer version of nonlinear programming example and Traveling Salesman Problem example			

**Self-Study Component**

Topics on latest / emerging technologies relevant to the course will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA.

**Expected Course Outcomes**

After going through this course the student will be able to

**CO1:** Understand the importance of decision making for optimal utilization of resources

**CO2:** Design and formulate real world problem by applying relevant mathematical models

**CO3:** Apply and Analyze various operations research techniques for obtaining solutions

**CO4:** Evaluate the solutions for obtaining optimal solution for the real world problems

**Reference Books**

1	Hamdy A Taha, "Operations Research - An Introduction", Pearson, 9 <sup>th</sup> Edition, 2014, ISBN: 978-93-325-1822-3, First Impression
2	Frederick S. Hillier & Gerald J. Lieberman, "Introduction to Operations Research", Tata McGraw Hill, 8 <sup>th</sup> Edition, 2007, ISBN-10: 0070600929, ISBN-13: 978-0070600928

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and One Self-study. The test will be for 30 marks each, quiz for 10 marks each and self-study for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students must answer five questions by selecting one from each unit. The questions will have internal choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Mapping of Course Outcomes(CO) to Program Outcomes(PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	H	M	L	-	-	-	-	L	L	M	M	M
<b>CO2</b>	M	M	-	-	M	-	-	-	M	-	-	-
<b>CO3</b>	M	M	M	M	L	-	M	M	L	M	M	M
<b>CO4</b>	L	H	L	H	-	-	L	M	M	M	L	-

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
<b>CO1</b>	H	M
<b>CO2</b>	H	M
<b>CO3</b>	M	M
<b>CO4</b>	L	M

**H –High, M-Medium, L-Low**

### III Semester

<b>Research Methodology</b>			
<b>Course Code</b>	:	16MCA35	<b>CIE Marks</b> : <b>100</b>
<b>Hrs/Week</b>	:	L:T:P:S 3:0:0:4	<b>SEE Marks</b> : <b>100</b>
<b>Credits</b>	:	4	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand and explain the underlying principles of quantitative and qualitative research			
2. Perform gap analysis and identify the overall process for designing a research study			
3. Choose the most appropriate research methodology to address a particular research problem			
4. Prepare a technical report, proposal to analyze data and suggest possible solutions			
<b>Unit – I</b>			<b>7 Hrs</b>
<b>Introduction</b> - Meaning of research, Types of research, Research and scientific method			
<b>Defining the research problem</b> - Selecting the problem, necessity of defining the problem, techniques involved in defining the problem			
<b>Research Design</b> – Meaning of research design, Need and features of a good Design, Different research designs			
<b>Unit – II</b>			<b>7 Hrs</b>
<b>Methods of Data Collection</b> -Experiment and Surveys, Collection of Primary data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection			
<b>Unit – III</b>			<b>07 Hrs</b>
<b>Design of Sample Surveys</b> -Sample Design, Sampling and Non sampling Errors, Sample survey v/s Census Survey, Types of Sampling Designs, Simple numerical problems			
<b>Unit – IV</b>			<b>08 Hrs</b>
<b>Data Preparation</b> - Data Preparation Process, Problems in Preparation Process, Missing Values and Outliers, Types of Analysis, Statistics in Research,			
<b>Descriptive Statistics</b> - Measures of Central Tendency, Measures of Dispersion, Hypothesis – Basic concepts of hypothesis, Testing of Hypothesis			
<b>Unit – V</b>			<b>7 Hrs</b>
<b>Essential Report Writing</b> - Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions of Writing a Research Report			

#### **Expected Course Outcomes**

After going through this course the students will be able to

**CO1:** Discuss various principles and concepts of quantitative and qualitative research

**CO2:** Identify appropriate method for data collection and processing for real world problem

**CO3:**Examine the research outputs in a structured manner and prepare report

**CO4:**Formulate research methodology for real world problems

<b>Reference Books</b>	
1.	Kothari CR, “Research Methodology Methods and Techniques “ , New Age International, 2014, 3 <sup>rd</sup> Edition, ISBN : 978-81-224-3623-5
2.	Krishnaswami KN , Sivakuma AI and Mathiarajan, “ Management Research Methodology” , Pearson Education, 2009, ISBN : 9788177585636
3.	Levin RI and Rubin, “Statistics for Management “, 7 <sup>th</sup> Edition, Pearson Education, New Delhi, ISBN : 9788177585841

### **Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and two self study components. The test will be for 30 marks each, quiz and self study for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

### **Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.

### **Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	L	M	L	M	M	L	L	M	-	L	-	-
<b>CO2</b>	L	H	H	H	M	-	-	-	-	L	L	-
<b>CO3</b>	-	-	-	-	M	M	L	-	L	-	L	-
<b>CO4</b>	M	H	H	H	H	L	M	-	-	M	-	-

### **Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
<b>CO1</b>	M	M
<b>CO2</b>	H	L
<b>CO3</b>	L	M
<b>CO4</b>	H	M
<b>H-High, M-Medium, L-Low</b>		

## IV Semester

<b>Enterprise Application Programming</b> (Theory and Practice)						
<b>Course Code</b>	:	<b>16MCA41</b>		<b>CIE Marks</b>	:	<b>100+50</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:2:0</b>		<b>SEE Marks</b>	:	<b>100+50</b>
<b>Credits</b>	:	<b>5</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>						
Graduates shall be able to						
<ol style="list-style-type: none"> <li>1. To understand and use different enterprise design pattern techniques</li> <li>2. Apply the knowledge of frameworks and Enterprise Application Development Tools</li> <li>3. Design a Java program efficiently using Inheritance, Interfaces and Packages</li> <li>4. Develop Enterprise Application solutions using Design Patterns</li> </ol>						
<b>Unit – I</b>						<b>09 Hrs</b>
<b>Introduction-</b> Challenges of Enterprise Application Development, Programming Productivity Response to Demand Integration with Existing Systems Freedom to Choose J2EE Application Scenarios , Multitier Application Scenario ,Stand-Alone Client Scenario, Web-Centric Application Scenario Business-to-Business Scenario , A Note on the MVC Architecture						
<b>Introduction to Java Programming-</b> The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, Java Keywords						
<b>Unit – II</b>						<b>09Hrs</b>
<b>Classes and Methods-</b> The Java Class Libraries. Java’s Primitive Types, Literals, Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Recursion, Understanding Static, Introducing nested and inner classes Inheritance Basics, Interface Fundamentals, Creating an Interface, Implementing an Interface, Package Fundamentals, Packages and Member Access, Importing Packages, Static						
<b>Unit – III</b>						<b>12 Hrs</b>
<b>Servlets-</b> Servlet Structure, Servlet packaging, HTML building utilities, Lifecycle, Single Thread model interface, Handling Client Request: Form Data, Handling Client Request: HTTP Request Headers. Generating server Response: HTTP Status codes, Generating server Response: HTTP Response Headers, Handling Cookies, Session Tracking						
<b>Introduction to EJB-</b> The Enterprise JavaBeans Tier-Business Logic, Enterprise Beans as J2EE Business Objects Enterprise Beans and EJB Containers, Session Beans						
<b>Unit – IV</b>						<b>08 Hrs</b>
<b>Implementing JSP tag extensions-</b> Overview of JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, Invoking java code with JSP scripting elements, creating Template Text, Invoking java code from JSP, Limiting java code in JSP, using JSP expressions, comparing servlets and JSP, writing scriptlets. For example Using Scriptlets to make parts of JSP conditional, using declarations, declaration example						

<b>Unit – V</b>		<b>10 Hrs</b>
<b>Persistence Management and Design Patterns-</b> Implementing java persistence using hibernate, Introducing hibernate, exploring the architecture of hibernate, exploring HQL, understanding hibernate O/R mapping, working with hibernate, Implementing O/R mapping with hibernate		
<b>Unit – VI (Lab Component)</b>		
<b>Part – A</b>		
<ol style="list-style-type: none"> <li>1. Write a Java program to               <ol style="list-style-type: none"> <li>a. Create a package named shape</li> <li>b. Create classes in the package representing common shapes like Square, Triangle, and Circle</li> <li>c. Import and compile these classes in other program</li> </ol> </li> <li>2. Write a Java Servlet Program to implement a dynamic HTML for following scenarios               <ol style="list-style-type: none"> <li>a. User name and password should be accepted in HTML</li> <li>b. Verify the username and password using a ServletConfig initparam and display the appropriate message on another Servlet</li> </ol> </li> <li>3. Write a Java Servlet Program to implement sessions (Using HTTP Session Interface)</li> <li>4. Write a Java Servlet Program to implement a JSTL to enter the customer details in HTML page and display the same in another HTML page</li> <li>5. Write a Java Servlet Program to count the number of hits to a website using Filters</li> <li>6. Write a Java Servlet Program to enter the login credentials and verify the same using hibernate frame work</li> </ol>		
<b>Part – B</b>		
<ol style="list-style-type: none"> <li>6. Write a JAVA Servlet Program to implement and demonstrate get() and post() methods (Using HTTP Servlet Class)</li> <li>7. Write a JAVA Servlet Program using cookies to remember user preferences.</li> <li>8. Write a Java Servlet program to display all the methods which are present in ServletConfig and ServletContext</li> <li>9. Write an EJB application to demonstrate Session Beans (with business logic)</li> </ol>		
<b>Course Outcomes</b>		
After going through this course the student will be able to		
<b>CO1:</b> Understand the challenges of enterprise applications		
<b>CO2:</b> Apply JAVA support and API skills for Enterprise Application Development		
<b>CO3:</b> Analyze the enterprise requirement to implement real world application		
<b>CO4:</b> Manage deployment configurations according to the enterprise application need		
<b>Reference Books</b>		
1.	Inderjeet Singh, Beth Stearns, Mark Johnson and the Enterprise Team “Designing Enterprise Applications” with the Java TM 2 Platform, Enterprise Edition, 2 <sup>nd</sup> Edition ISBN-10: 0201787903	
2.	Herbert Schildt, Dale Skrien, “Java Fundamentals, A Comprehensive Introduction ”, Tata McGraw Hill Edition, 2013, Mc Graw Hill Publication, ISBN-13:9781249006593	

3.	Marty Hall, Larry Brown, “Core Servlets and Java Server Pages. Volume 1: Core Technologies. 2 <sup>nd</sup> Edition” Pearson Hall, ISBN-13: 97886278043.
4.	Prof. M. T. Savaliya, “Advanced Java”, Dreamtech Press, Wiley India, ISBN-13: 9789351199342.

### **Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

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CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

### **Scheme of Semester End Examination(SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.

### **Scheme of Semester End Examination(SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage of Part A is 70% and Part B weightage is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

### **Mapping of Course Outcomes(CO) to Program Outcomes(PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	L	-	H	L	M	L	M	L	-	-
CO2	M	-	L	-	H	L	M	L	M	L	-	-
CO3	H	H	M	M	H	M	L	M	H	M	L	-
CO4	H	-	L	L	H	-	L	M	L	-	L	-

### **Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	L	L
CO2	M	M
CO3	H	M
CO4	H	H

**H –High, M-Medium, L-Low**



<b>IV Semester</b>			
<b>Elective – III</b>			
<b>Advanced Computer Networks</b>			
<b>(Theory and Practice)</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA421</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Familiarize the working of the various protocols in TCP/IP stack			
2. Understand the working and performance of connection oriented networks such as ATM			
3. Get a practical approach on multitude of algorithms related to Advanced routing			
4. Acquaint with the real-time application of networking			
<b>Unit – I</b>			<b>10Hrs</b>
<b>Concepts of Storage Network-</b> Data Storage and Data Access Problem, The Battle for Size and Access, Decoupling the Storage Component- Putting Storage on the Network, Creating a Network for Storage.			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Internet Protocol-</b> Error and Control Messages (ICMP), The Internet Control Message Protocol, ICMP Message Delivery, ICMP Message Format, Testing Destination Reachability and status, Echo Request and Reply Message Format, Classless and Subnet Address Extension (CIDR) – Review of Relevant Facts, Proxy ARP, Subnet Addressing, Subnet Mask Representation, Broadcasting the Subnets, A Classless Addressing example			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Mobile IP -</b> Introduction, Mobility, Routing and Addressing, Mobile IP Characteristics, Overview of Mobile IP Operations, Mobile Addressing Details, Foreign Agent Discovery, Agent Registration, registration message format, communication with a foreign agent, datagram transmission and reception, two- crossing problem, communication with computers on the home network			
<b>Private Network Interconnection-</b> NAT, VPN- Introduction, Private and hybrid networks, VPN, VPN addressing and routing, VPN with private address, NAT, NAT translation table creation, multi address NAT, Port mapped NAT, interaction between NAT and ICMP, Interaction between NAT and applications. Conceptual address domains			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Wireless Communication-</b> Introduction – Fundamentals of Wireless Communication Technologies, The Electromagnetic Spectrum, Characteristics of the Wireless Channel, Wireless LANS and PANS – Fundamentals of WLAN's, HIPERLAN Standard, Bluetooth, Wireless WANS and MANS – The Cellular Concept, Wireless ATM			
<b>Unit – V</b>			<b>08 Hrs</b>

**Ad-hoc Networking-** Introduction, Issues in Designing a Routing Protocol for AdHoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocol- Destination Sequenced Distance Vector Routing Protocol, Wireless Routing Protocol, On-Demand Routing Protocol- Dynamic Source Routing Protocol, Ad Hoc On-demand Distance Vector Routing Protocol, Hybrid Routing Protocol - Zone Routing Protocol.

**Unit – VI (Lab Component)**

**Implement the following programs using NS2**

**Part – A**

1. Simulate a gateway implementation of a LAN consisting of 8 nodes.
2. Simulate client server communication between two nodes A and B. Measure the packet delivery rate at the client. Create a dumbbell topology with 8 nodes using TCP and UDP connection
3. Simulate a star topology with 10 nodes n0 ... n9 where node n4 is acting as router.
4. Write a script to wired network with star topology and demonstrate QoS monitoring.
5. Consider a small network with four nodes n0, n1, n2 and n3 forming point to point connection with each other. Implement IEEE 802.3 standard offering CSMA. Display packet delivery count and ratio between TCP source (n0) and TCP sink (n3)

**Part – B**

1. Write a script to define Software Defined Network to facilitate accessing any one sensor data remotely.
2. Write a script to define a wireless network with star topology and demonstrate QoS monitoring
3. Simulate a wireless network and demonstrate DSR protocol.
4. Simulate the wireless network under 802.11 standards and demonstrate AODV protocol
5. Simulate the wired distance vector routing algorithm

**Expected Course Outcomes**

At the end of the course the student will be able to

**CO1:** Understand the advanced networking concepts and its applications

**CO2:** Apply various networking classifications in day to day computing

**CO3:** Analyze the importance of routing and congestion control principles

**CO4:** Access the different routing protocol methods in the networking support layers

**Reference Books**

1	Robert Spalding, “The Complete Reference-Storage Networks”, McGraw Hill Education, Indian Edition 2003, ISBN -13: 978-0-07-053292-2,
2	C. Siva Ram Murthy, B. S. Manoj, “Ad Hoc Wireless Networks Architecture and Protocols”, Pearson Publication, 2011, ISBN 978–81-317-5905-9
3	Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols, and Architectures”, Volume 1, 4 <sup>th</sup> Edition, Pearson Education, 2001, ISBN 81-7808-444-9

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The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

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**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	H	M	L	-	-	-	-	M	M	L	H	M
CO2	H	L	M	H	L	-	-	L	M	M	-	-
CO3	M	-	H	M	-	-	-	M	M	M	M	L
CO4	H	M	L	H	-	L	-	L	H	M	L	M

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	M	H
CO2	H	M
CO3	M	M
CO4	H	H

H –High, M-Medium, L-Low

## IV Semester

**Elective – III**  
**Mobile Application Development**  
**(Theory and Practice)**

<b>Course Code</b>	<b>: 16MCA422</b>	<b>CIE Marks</b>	<b>: 100+50</b>
<b>Hrs/Week</b>	<b>: L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	<b>: 100+50</b>
<b>Credits</b>	<b>: 5</b>	<b>SEE Duration</b>	<b>: 3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand and compare different mobile application models, architectures and patterns			
2. Interpret the components and structure of a mobile development framework			
3. Apply suitable framework for the development of a mobile application			
4. Develop a mobile application for a real world scenario			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction to Mobile Application Development Ecosystems-</b> History of Mobile Application Development, Understanding Ecosystems, Hybrid Application Frameworks, Challenges by Mobile Application Layers, System Software, Mobile Application Testing			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Getting Started with Android Programming &amp; Android User Interface-</b> What is Android? Obtaining the required tools, Creating your First Android Application, Anatomy of an Android Application, View Groups, Basic views, Fragments			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>SMS Messaging and Networking-</b> Sending SMS Messages programmatically, Getting Feedback after Sending the Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warning, Sending E-Mail <b>Networking-</b> Downloading Binary Data, Downloading Text Files, Accessing Web Services Using the GET Method, Performance Asynchronous Calls			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Creating Location Based Services Applications-</b> Displaying Maps, Creating the Project, Obtaining the Maps API Key, Displaying the Map, Displaying the Zoom Control, Changing Views, Navigating to a specific Location, Adding Markers, Geocoding and Reverse Geocoding, Getting Location Data			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>Publishing Android Applications-</b> Versioning, Digitally Signing your Android Applications <b>Deploying APK Files-</b> Using the adb.exe Tool, Using a Web Server, Publishing on the Android Market			
<b>Unit – VI (Lab Component)</b>			

**PART – A**

1. Create “Hello World” application that will display “Hello World” in the middle of the screen
2. Devise sample application with login module to check username and password and proceed to next screen and on failing login, alert user using Toast Message
3. Develop an application that will change color of the screen, based on selected options from the menu
4. Read phonebook contacts using content providers and display in list
5. Build a screen containing menu and submenus displaying different types of automobiles and models
6. Implement an application that will create database with a table of User credentials and create login portal system

**PART – B**

1. Develop a program that provides various text and color effects to the text entered by the user
2. Write a program to display toast message on specific interval of time on successful login and navigating to the RVCE portal at the end of the Timer
3. Build a program that will navigate to the specific URLs deployed in the menu to the browser from the app
4. Create an application to send SMS to a particular contact from the Phonebook
5. Build an application to perform CRUD (create, read, update and delete) operations on the information of automobiles on the database and email the details to the provided email address
6. Develop a mobile application to save GPS location information of a particular phone on a database upon successful login

**Note : Students are required to implement all the programs in Part-A and Part B**

**Course Outcomes**

After going through this course the student will be able to

**CO1:** Understand the architectures, user interfaces that leverage evolving mobile device capabilities

**CO2:** Demonstrate mobile applications using software development kits (SDKs), frameworks and toolkits

**CO3:** Identify various methods to integrate frameworks, database and system-side technologies

**CO4:** Develop mobile applications and implement competent mobile applications as Digital World solutions

**Reference Books**

- |    |  |
|----|--|
| 1. | Mahesh Panhale, “Beginning Hybrid Mobile Application Development”, Apres 2016, ISBN 978-1-4842-1314-8, DOI 10.1007/978-1-4842-1314-8 |
| 2. | Wei-Meng Lee, “Beginning Android Application Development”, Wiley 2011, ISBN-13: 978-1118017111                                       |

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CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

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consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

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The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

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**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	L	M	L	-	M	M	H	M	H	-
CO2	L	H	L	H	L	-	M	H	M	H	M	L
CO3	L	L	-	-	-	-	L	-	M	L	M	-
CO4	L	L	-	M	H	-	M	L	L	M	L	L

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	M	L
CO2	H	M
CO3	L	L
CO4	M	H

H-High, M-Medium, L-Low

## IV Semester

**Elective – III**  
**Computer Graphics**  
**( Theory & Practice )**

<b>Course Code</b>	<b>: 16MCA423</b>	<b>CIE Marks</b>	<b>: 100+50</b>
<b>Hrs/Week</b>	<b>: L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	<b>: 100+50</b>
<b>Credits</b>	<b>: 5</b>	<b>SEE Duration</b>	<b>: 3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand the basics underlying concepts in Analytical geometry and Computer Graphics			
2. Identify various graphical algorithms to construct graphical primitives			
3. Use and Evaluate various geometric transformations and viewing techniques			
4. Explore advanced OpenGL built in functions for Animation and Illumination techniques			
5. Develop graphical programs for multidisciplinary environment			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction</b> -Computer Graphics Hardware- Video display devices, Input devices, Graphics on Internet, Computer Graphics Software- Introduction to OpenGL, Coordinate Reference Frames, Specifying a Two Dimensional World Coordinate Reference frame in Open GL, OpenGL Point Functions, OpenGL Line Functions, OpenGL Polygon Fill Area functions, Line generation algorithms–DDA, Bresenham’s Line Generation, Mid-point Circle Generation algorithm			
<b>Unit – II</b>			<b>10Hrs</b>
<b>Two Dimensional Geometric Transformations</b> -Two Dimensional Translation, Rotation, Scaling, Reflection and Shear Geometric Transformation, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Other Two Dimensional Geometric Transformation, Open GL Geometric Transformation Functions			
<b>Unit – III</b>			<b>10Hrs</b>
<b>Two Dimensional Viewing</b> -The two dimensional viewing pipeline, Clipping window, Normalization and viewport transformations, Clipping algorithms, Two dimensional point clipping, Two dimensional line clipping algorithms- Polygon fill area clipping, Text clipping			
<b>Unit – IV</b>			<b>09Hrs</b>
<b>Three Dimensional Geometric Transformations, Viewing and Curves</b> -Three Dimensional Translation, Rotation, Scaling, The three dimensional viewing concepts, Three dimensional viewing pipeline, Orthogonal Projection, Oblique Parallel Projection, Perspective Projection, Bezier spline curves			
<b>Unit – V</b>			<b>09Hrs</b>
<b>Computer Animation, Illumination Models</b> - Raster methods for computer animation, Design of animation sequences, Traditional animation techniques, General computer animation functions, OpenGL illumination and Surface rendering functions			
<b>Unit –VI (Lab Component)</b>			

**Part - A**

1. Write a program to implement Bresenham's line drawing algorithm with slope  $|m| < 1$
2. Write a program to implement mid-point circle generation algorithm
3. Write a program to implement scaling transformation in X-Y Plane for the object square without using built-in function
4. Write a program to implement reflection transformation in X- axis and Y axis for the object triangle without using built-in function
5. Write a program to implement cavalier and cabinet projection with angle  $45^0$  for the object cube without using built in function

**Part - B**

1. Write a program to implement rotation of a triangle with animation effect
2. Develop a screen saver using points displaying at random position
3. Write a program to display sun with animated rays using mouse events
4. Develop a 3D cube color model with color animation
5. Write a program to apply illumination effects to an object
6. Write a program to develop Bezier surface with shading effect

**Note :**

1. Part-B programs can be executed using Open GL built-in functions
2. During examination, each student picks one question from the lot of 5 questions from Part - A and one question from the lot of 6 questions from Part – B. Both need to be executed
3. No change of programs is permitted

**Expected Course Outcomes**

After going through this course the student will be able to

**CO1:** Illustrate the fundamentals of computer graphics hardware and software concepts

**CO2:** Demonstrate computer graphics algorithms with data and its specifications

**CO3:** Apply algorithms on different graphical models

**CO4:** Analyze different algorithms to manage graphical objects and resources

**Reference Books**

- |   |   |
|---|---|
| 1 | Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, 4 <sup>th</sup> Edition, 2014, Second Impression, ISBN 978-93-325-1871-1 |
| 2 | Edward Angel, Dave Shreiner, "Interactive Computer Graphics – A Top down Approach using OpenGL", Addison-Wesley, 6 <sup>th</sup> Edition, 2012, ISBN-13: 978-0-13-254523-5        |

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO2	M	L	M	L	M	-	L	-	L	-	L	-
CO3	L	L	M	-	M	-	L	-	L	L	L	-
CO4	L	M	L	-	-	-	M	-	L	L	-	-

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	M	L
CO2	M	M
CO3	M	M
CO4	L	L

H –High, M-Medium, L-Low

## IV SEMESTER

**Elective – IV**  
**Network Security**

<b>Course Code</b>	<b>:</b>	<b>16MCA431</b>	<b>CIE Marks</b>	<b>:</b>	<b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L :T :P: S 4:0:0:4</b>	<b>SEE Marks</b>	<b>:</b>	<b>100</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b>	<b>:</b>	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Explain security concepts involving OSI security architecture and a model for security involving attacks, services and mechanisms					
2. Introduce the working of classical, symmetric and asymmetric techniques, hashes and message digests, and public key algorithms					
3. Familiarize design issues and working principles of various secure communication standards covering Kerberos, certificate & standards, IPsec & SSL/TLS					
4. Indicate the significance of Email and web security concepts					
5. Enhance the knowledge on implementation of different intrusion detection principles and firewall implementations					
<b>Pre-requisite:</b> Student must know the concepts of computer networks (16MCA31)					
<b>Unit – I</b>					<b>08 Hrs</b>
<b>Introduction-</b> Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, , A Model for Network Security <b>Symmetric Encryption and message confidentiality-</b> Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Public-Key Cryptography and Message Authentication-</b> Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public Key Cryptography Principles, Public Key Cryptography Algorithms (RSA Algorithm and Diffie-Hellman Key Exchange), Digital Signatures <b>Key Distribution and User Authentication-</b> Kerberos ( Version 4 & 5), X.509 Certificates, Public Key Infrastructure					
<b>Unit – III</b>					<b>10 Hrs</b>
<b>Network Access Control and Cloud Security-</b> Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control, Cloud Computing, Cloud Security Risks and Countermeasures, Data Protection in the Cloud, Cloud Security as a Service					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Transport-Level Security-</b> Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS Secure Shell (SSH) <b>Wireless Network Security-</b> Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security <b>Electronic Mail Security-</b> Pretty Good Privacy (PGP), S/MIME, Domain Keys Identified Mail (DKIM) <b>IP Security-</b> IP Security Overview, IP Security Policy, Encapsulating Security Payload,					

Combining Security Associations, Internet Key Exchange	
<b>Unit – V</b>	<b>10 Hrs</b>
<p><b>Malicious Software</b>-Types of Malicious Software, Propagation – Infected Content – Viruses, Propagation – Vulnerability Exploit – Worms, Propagation – Social Engineering – SPAM, Trojans, Payload – System Corruption, Payload – Attack Agent – Zombie, Bots, Payload – Information Theft – Key loggers, Phishing, Spyware, Payload – Stealthing – Backdoors, Root kits, Countermeasures, Distributed Denial of Service Attacks.</p> <p><b>Intruders</b> -Intruders, Intrusion Detection, Password Management</p> <p><b>Firewalls</b>-The Need for Firewalls, Firewall characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations</p>	
<p><b>Self-Study Component -</b> Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by a expert panel in two phases appointed by the Director, MCA</p> <p><b>Topics</b> Topics on Network security will be assigned. Students are required to work on the tools specified in phase I and Phase II . Phase 1: Nessus (vulnerability scanners), Wireshark (packet sniffers- previously known as Ethereal), Snort (IDS - intrusion detection system) Phase 2: Netcat (Netcat), Metasploit Framework (vulnerability exploitation tools), TCPDump (packet sniffers)</p>	
<p><b>Course Outcomes</b> After going through this course the students will be able to <b>CO1:</b> Define and illustrate network security concepts and principles <b>CO2:</b> Analyze the working of security principles to system design <b>CO3:</b> Apply appropriate techniques to solve network security threats <b>CO4:</b> Evaluate system security using network security controls</p>	
<b>Reference Books</b>	
1.	William Stallings “Network Security Essentials Applications and Standards”, 5 <sup>th</sup> Edition, 2014 , Pearson, ISBN-13 9780133370522.
2.	William Stallings, “Cryptography and Network Security: Principles and Practice”, 6 <sup>th</sup> Edition, 2014, Pearson, ISBN-13 9780133354690.
3.	Charles P Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, “Security in computing”, 5 <sup>th</sup> Edition, 2015 Prentice Hall, ISBN-13 9780134085043.

**Scheme of Continuous Internal Evaluation (CIE)**

CIE will consist of Two Tests, Two Quizzes and self-study. The test will be for 30 marks each, quiz and self-study for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	H	H	M	H	H	L	M	M	M	-	L	M
<b>CO2</b>	H	H	M	M	H	-	M	M	M	-	-	L
<b>CO3</b>	H	H	M	M	H	L	L	L	L	-	L	-
<b>CO4</b>	H	H	M	H	H	-	M	M	M	-	L	L

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
<b>CO1</b>	M	L
<b>CO2</b>	M	L
<b>CO3</b>	M	L
<b>CO4</b>	M	L

**H-High, M-Medium, L-Low**

## IV Semester

**Elective – IV**  
**Information Retrieval**

<b>Course Code</b>	:	<b>16MCA432</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:0:4</b>		<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>5</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>						
Graduates shall be able to						
1. Use different information retrieval techniques in various application areas						
2. Apply IR principles to locate relevant information large collections of data						
3. Analyze performance of retrieval systems large or unmanaged data sources						
4. Implement retrieval systems for web search tasks						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Introduction to information retrieval and architecture of a search engine-Search Engines and Information Retrieval-</b> What Is Information Retrieval? The Big Issues, Search Engines, Search Engineers						
<b>Architecture of a Search Engine-</b> What is an Architecture? Basic Building Blocks, Breaking It Down						
<b>Unit – II</b>						<b>10 Hrs</b>
<b>Crawls and Feeds-</b> Deciding what to search, Crawling the Web, Crawling Documents and Email, Document Feeds, The Conversion Problem, Storing the Documents, Detecting Duplicates						
<b>Processing Text -</b> From Words to Terms, Text Statistics, Document Parsing, Document Structure and Markup, Link Analysis, Information Extraction, Internationalization						
<b>Unit – III</b>						<b>10 Hrs</b>
<b>Ranking with Indexes -</b> Overview, Abstract Model of Ranking, Inverted indexes, Compression, Auxiliary Structures, Index Construction, Query Processing						
<b>Unit – IV</b>						<b>08Hrs</b>
<b>Queries and Interfaces-</b> Information Needs and Queries, Query Transformation and Refinement, Showing the Results, Cross-Language Search						
<b>Unit – V</b>						<b>10 Hrs</b>
<b>Retrieval Models -</b> Overview of Retrieval Models , Probabilistic Models, Ranking Based on Language Models, Complex Queries and Combining Evidence, Web Search, Machine Learning and Information Retrieval						
<b>Evaluating Search Engines-</b> Why Evaluate?, The Evaluation Corpus, Effectiveness Metrics, Efficiency Metrics						
<b>Self-Study Component</b>						
Topics on latest / Emerging technologies will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA						

**Expected Course Outcomes**

After going through this course the student will be able to

- CO1: Understand the concept of Information Retrieval, its models and Search Engine  
 CO2: Recognize and use various indexing and querying techniques to store and retrieve documents  
 CO3: Apply IR principles to extract relevant information and build retrieval models  
 CO4: Analyze and evaluate the IR techniques and retrieval models

**Reference Books**

1. Trevor Strohman, Bruce Croft Donald Metzler, "Search Engines: Information Retrieval in Practice", Kindle Edition, Pearson Education Inc., 2015, ISBN-13: 978-0136072249
2. Christopher D. Manning, Prabhakar, Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, 2008, ISBN 978-0-521-86571-5
3. William B Frakes, Ricardo Baeza-Yates, "Information Retrieval Data Structures and Algorithms", Pearson Education, 3<sup>rd</sup> Edition, 2009. ISBN13: 9780134638379
4. Robert. R. Korfhage, "Information Storage & Retrieval", John Wiley & Sons, Inc. New York, NY, USA, 4<sup>th</sup> Edition, 1997, ISBN:0-471-14338-3

**Scheme of Continuous Internal Evaluation (CIE)**

CIE will consist of Two Tests, Two Quizzes and Self study. The test will be for 30 marks each, quiz and self study for 20 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	M	L	L	H	M	M	-	M
CO2	H	H	H	M	M	L	L	H	M	L	-	M
CO3	H	H	H	L	M	L	L	H	M	L	-	M
CO4	H	H	H	L	M	L	L	H	M	L	-	M

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	L	L
CO2	M	M
CO3	M	M
CO4	H	H

H –

High, M-Medium, L-Low

## IV Semester

**Elective – IV**  
**Modeling And Simulation**

<b>Course Code</b>	<b>: 16MCA433</b>	<b>CIE Marks</b>	<b>: 100</b>
<b>Hrs/Week</b>	<b>: L:T:P:S 4:0:0:4</b>	<b>SEE Marks</b>	<b>: 100</b>
<b>Credits</b>	<b>: 5</b>	<b>SEE Duration</b>	<b>: 3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
<ol style="list-style-type: none"> <li>1. Understand the basics of simulation and various simulation models</li> <li>2. Distinguish different types of random number and variate generation techniques for solving problems through statistical functions</li> <li>3. Explore verification, validation and optimization on simulation models</li> <li>4. Estimate the performance of system simulation models</li> </ol>			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>Introduction</b> -Discrete and continuous systems, Model of a system, Types of Models, Discrete-Event System Simulation, Steps in a Simulation Study			
<b>Statistical Models in Simulation</b> -Discrete Random Variables, Continuous Random Variables, Cumulative distribution function, Useful statistical models, Discrete distributions, Continuous distributions- Uniform distribution, Exponential distribution, Normal distribution, Empirical distributions			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Random-Number Generation</b> - Properties of random numbers, Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for random numbers			
<b>Random-Variate Generation</b> - Inverse transform technique, Acceptance-Rejection technique			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Simulation Examples</b> - Waiting Line Models, Simulating a Single-Server Queue, Simulating a Queue with Two Servers, News Dealer's Problem			
<b>General Principles</b> - Concepts in Discrete-Event Simulation, The Event-Scheduling / Time-Advance Algorithm, Manual simulation using Event Scheduling			
<b>Unit – IV</b>			<b>09 Hrs</b>
<b>Input Modeling</b> - Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting Input models without data, Multivariate and Time-Series input models			
<b>Verification and Validation</b> - Model building, verification and validation, Verification of simulation models, Calibration and validation of models			
<b>Unit – V</b>			<b>09 Hrs</b>
<b>Estimation of Absolute Performance</b>			
Absolute measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations- Initialization bias & Error estimation for steady state simulation, Optimization via Simulation, Case Studies - CPU and Memory utilization of the computer			

<b>Self-Study Component</b>												
Topics on latest / Emerging technologies will be assigned. Students are required to read white papers, publications, patents and prepare a report, give a seminar on the study undertaken. The self study will be reviewed and evaluated by an expert panel in two phases appointed by the Director, MCA												
<b>Course Outcomes</b>												
After going through this course the student will be able to												
<b>CO1:</b> Understand the fundamentals of Simulation and various simulation models using real world examples												
<b>CO2:</b> Design a simulation model for solving a real world Problem												
<b>CO3:</b> Apply different techniques for simulation models												
<b>CO4:</b> Evaluate and analyze the results of the Simulation models												
<b>Reference Books</b>												
1	Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation”, Pearson Education, 5 <sup>th</sup> Edition, 2013, ISBN: 978-81-317-9699-3 first impression											
2	Geoffrey Gordon, “System Simulation”, Pearson Education, 2015, ISBN: 9789332550247											
<b>Scheme of Continuous Internal Evaluation (CIE)</b>												
CIE will consist of Two Tests, Two Quizzes and Self study. The test will be for 30 marks each, quiz and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks.												
<b>Scheme of Semester End Evaluation (SEE)</b>												
The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions, selecting one from each unit. The questions will have Internal choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.												
<b>Mapping of Course Outcomes (CO) to Program Outcomes (PO)</b>												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	-	-	-	-	L	L	M	M	M
CO2	M	M	-	-	M	-	-	-	L	-	-	-
CO3	M	M	M	M	L	-	M	M	L	M	M	M
CO4	L	H	L	H	-	-	L	M	M	M	L	-
<b>Mapping of Course Outcomes(CO) to Program Specific Outcomes (PSO)</b>												
	PSO1						PSO2					
CO1	H						M					
CO2	H						M					
CO3	M						M					
CO4	L						M					
<b>H-High, M-Medium, L-Low</b>												



## IV Semester

## Software Project Management

<b>Course Code</b>	<b>: 16MCA44</b>	<b>CIE Marks</b>	<b>: 100</b>
<b>Hrs/Week</b>	<b>: L:T:P:S 3:2:0:4</b>	<b>SEE Marks</b>	<b>: 100</b>
<b>Credits</b>	<b>: 5</b>	<b>SEE Duration</b>	<b>: 3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Understand the principles and components of software project management and its applications in real life			
2. Apply project evaluation and programme management techniques			
3. Discover the processes involved in Project Planning, Project Cost and Risk Management			
4. Understand the techniques in project monitoring and control, manage people and imbibe Ethics			
<b>Unit – I</b>			<b>08 Hrs</b>
<b>Introduction to Software Project Management-</b> Introduction, Why is Software Project Management important?, What is a Project?, Software Projects versus other types of Project, Contract Management and Technical Project Management, Activities covered by software project management, Plans, methods & Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, What is Management?, Management Control, Traditional versus Modern Project Management Practices			
<b>Unit – II</b>			<b>08 Hrs</b>
<b>Project Evaluation and Programme Management-</b> Introduction, A Business Case, Project Portfolio Management, Evaluation of individual projects, Cost-Benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the allocation of resources within Programmes, Strategic Programme Management, Creating a Programme, Aids to Programme Management, Some reservations about Programme Management, Benefits Management.			
<b>Unit – III</b>			<b>08 Hrs</b>
<b>An Overview of Project Planning-</b> Introduction to Step-wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyze Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Efforts for each activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review / Publicize Plan, Step 9 & 10: Execute Plan / Lower Levels of Planning			
<b>Unit – IV</b>			<b>06 Hrs</b>
<b>Activity Planning-</b> Introduction, The Objectives of Activity Planning, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the time dimension, Forward Pass, The Backward Pass, Identifying the critical path, Activity Float, Shortening the Project duration, Identifying critical activities, Activity-on-Arrow Networks			
<b>Risk Management</b> – Risk, Categories of Risk, Risk Identification, Risk Assessment, Risk Planning and Risk Management			
<b>Monitoring and Control-</b> Introduction, Creating the Framework, Collecting the Data, Review, Project Termination Review, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project back to Target, Change Control, Software Configuration Management (SCM)			
<b>Unit – V</b>			<b>06 Hrs</b>

**Managing People in Software Environments**-Introduction, Understanding Behavior, Organizational Behavior: A Background, Selecting the right person for the job, Instructions in the Best methods, Motivation, The Oldham-Hackmann Job Characteristics Model, Stress, Health & Safety, Some Ethical and Professional Concerns  
**Software Quality**- ISO 9126, Product and project metrics, quality plans

### Course Outcomes

After going through this course the students will be able to

**CO1:** Explain the practices and methods for successful software project management

**CO2:** Identify techniques for requirement, policies and decision making for effective resource management

**CO3:** Apply the evaluation techniques for estimating cost ,benefit, schedule and risk

**CO4:** Devise a framework for planning software project management activities, risk, staffing, monitoring and control

### Reference Books

1. Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, Tata McGraw-Hill Education, Delhi, Special Indian Edition, 5<sup>th</sup> Edition, 2011, ISBN-13: 978-0-07-107274-8, ISBN-10: 0-07-107274-8
2. Harold Kerzer, “Project Management, A System approach to planning Scheduling & Controlling”, John Wiley & Sons Inc., 11<sup>th</sup> Edition, 2013, ISBN 978-1-118-02227-6

### Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes, Tutorial and Self Study. The test will be for 30 marks each, quiz for 10 marks each and self study for 20 marks. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Semester End Examination (SEE) for Theory

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions by selecting one from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.

### Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	M	-	H	M	M	M	-	-
CO2	M	M	H	H	L	M	H	M	-	M	-	-
CO3	M	H	M	H	-	L	H	-	-	M	-	-
CO4	H	L	M	M	M	M	H	M	-	H	-	-

### Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)

	PSO1	PSO2
CO1	M	M
CO2	M	M
CO3	H	H
CO4	H	H

**H-High, M-Medium, L-Low**

## IV Semester

<b>Business Communication</b>					
<b>Course Code</b>	:	<b>16MCA45</b>	<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 3:0:0:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>3</b>	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Identify the need and importance of Communication					
2. Understand the different types of communication and apply efficiently					
3. Demonstrate Presentations skills in an effective manner					
4. Explore personal and Interpersonal skills to improve Group Communication					
5. Apply concise integration of various aspects of communication					
<b>Unit – I</b>					<b>08 Hrs</b>
<b>Basics of Communication, Communication: An Overview</b> – Definitions, Nature and Attributes of Communication, Purpose of Communication, Directions of Communication, Types of Communication, Kinds of Communication Network – Internal & External, Channels of Communication, Methods of Communication – Verbal and Non-Verbal					
<b>Process of Communication-</b> Objectives of Communication, Basic elements of Communication process, Process of Communication, Models of Communication Process					
<b>Effective Communication-</b> Essentials of Effective Communication, 7Cs of Effective Communication, 4Ss of Effective Communication, IMPRESS Model					
<b>Barriers to Communication</b> –What is Miscommunication? Barriers of Communication, Categorization of Barriers to Communication, Methods of Overcoming Communication Barriers					
<b>Unit – II</b>					<b>08 Hrs</b>
<b>Oral and Non-Verbal Communication- Oral Presentation Skills</b> – Major Areas of Verbal Communications, Purpose of Oral Presentation, Structuring the Presentation, Preparation before Presentation, Starting a Presentation, Introduction to a Presentation, Patterns of Presentation, Types of delivery in Oral Presentations, Organizing the Presentation, Main body of the Presentation, Concluding a Presentation, Basic guidelines for designing the Presentation, Suggestion for Improving Presentation delivery					
<b>Listening Skills</b> – Definitions of Listening, Importance of Listening, Difference between Listening and Hearing, Principles of good Listening, Process of Listening, basic Listening modes, approaches to Listening, Types of Listening, Advantages of Listening, Barriers to effective Listening, Common faults of Listening, Methods & Strategies to improve Listening, Guidelines for effective Listening, Ten Commandments of Listening					
<b>Interview</b> – Meaning and Definition, Purpose of Interview, Essential features of Interview, Methods of Interview, Styles of Interviewing, Types of Interview, Possible Job interview questions, Handling Job Interview questions					
<b>Non-Verbal Communication</b> – Common Indicators of Non-Verbal Communication, Features of Non-Verbal Communication, Types of Non-Verbal Communication (Proxemics, Kinesics, Paralanguage, Oculistics, Artifacts, Tactilics / Haptics)					
<b>Unit – III</b>					<b>07 Hrs</b>

<b>Written Communication – Part I</b>	
<b>Business Letters</b> – Meaning of Business Letter, Essentials of a good Business Letter, Basic Considerations, Styles of a Letter Layout, Parts of a Business Letter, <b>Types of Business Letters</b> –Types of Business Letters, Differences between a memorandum and a Letter <b>E-Mail Writing</b> –What makes E-mail different?, Origin, Structure of an E-Mail, Signatures, Types of usage of E-Mail, E-Mail Abbreviations and Acronyms, Organizing E-mail messages, E-mail Etiquette, Tips for E-mail Effectiveness, Advantages and Limitations of E-mail <b>Paragraph Writing</b> – What is a Paragraph?, Classification of a Paragraph, Building Paragraphs, 5-Step Process to Paragraph Development, Prewriting Paragraphs, Coherence and Unity in Paragraph Writing	
<b>Unit – IV</b>	<b>07 Hrs</b>
<b>Written Communication – Part II</b>	
<b>Job Application and Resume Writing</b> – Definition of a Job Application Letter, Features of Job Application Letter, Types of Job Application Letter, Contents of an Application Letter, Tips for Drafting an Application Letter, Checklist: Writing Job Application Letters, Resume, Resume vs. Curriculum Vitae, Types of Resumes, Potential Errors with Resume Writing, Essential Parts of a Resume, Ten Key Points in writing effective resume <b>Report Writing</b> – Definition of a report, Basic Features of a Report, Purpose of a Report, Requirements of a Report, Characteristics of a good Report, Generally accepted Principles of Effective Report Writing, Types of Reports, Parts of a Report, Style of Reports, Report planning, Stages of Report Preparation, Tips on Report Preparation	
<b>Unit – V</b>	<b>06 Hrs</b>
<b>Applications</b>	
<b>Assertiveness</b> – Positive/Negative Thinking, Assertive Rights, Strategies for Assertive Behavior, Indicators of Assertive Behaviour, Success in Relationships, How to say No?, Mental Locks <b>Body Sport</b> – Positive Gestures, Handshakes, The Gazes, Smiles, Hand Movements, Different Styles of Walking, Voice Modulations <b>Group Discussions</b> and Interviews–Group Discussions, Strategies for Group Discussions, Interviews, Facing the Interview Board, Body Sport for Interviews, Negotiations	
<b>Course Outcomes</b>	
After going through this course the students will be able to <b>CO1:</b> Understand the need and significance of Communication <b>CO2:</b> Comprehend the different types of communication in Organizations <b>CO3:</b> Deliver Presentations effectively with positive group communication exchanges <b>CO4:</b> Demonstrate Interpersonal skills proficiently and apply the concepts in Business Environment	
<b>Reference Books</b>	
1.	Sathya Swaroop, Debasish, and Bhagaban Das, “Business Communication”. PHI Learning Pvt. Ltd., New Delhi, 2010. ISBN: 978-81-203-3729-9
2.	Asha Kaul, “Business Communication”, PHI Learning Pvt. Ltd, New Delhi, 2 <sup>nd</sup> Edition, 2010, ISBN: 978-81-203-3848-7
3.	P D Chaturvedi and Mukesh Chaturvedi, “Business Communication: Concepts, Cases and Applications”, Pearson Education, 2 <sup>nd</sup> Edition, 2007. ISBN: 978-81-317-0172-7
<b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b>	
CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks	

each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

#### **Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

#### **Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	-	-	-	-	-	L	M	-	H	-	L	L
<b>CO2</b>	-	-	-	-	-	L	M	-	H	-	-	L
<b>CO3</b>	-	-	-	-	-	L	M	M	H	-	M	M
<b>CO4</b>	-	-	-	-	-	L	M	M	H	-	H	H

#### **Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
<b>CO1</b>	H	L
<b>CO2</b>	M	L
<b>CO3</b>	H	L
<b>CO4</b>	M	L

**H-High, M-Medium, L-Low**

## IV Semester

## MINOR PROJECT – I

<b>Course Code</b>	:	<b>16MCA46</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>0:0:10:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>05</b>		<b>SEE Duration</b>	:	<b>3 Hours</b>
<b>Course Learning Objectives (CLO):</b>						
Students are able to						
1. Understand the method of applying computational knowledge to solve specific problems						
2. Apply software engineering and management principles while executing the project						
3. Demonstrate the skills for good presentation and technical report writing skills						
4. Identify and solve complex computing problems using professionally prescribed standards						
<b>GUIDELINES</b>						
1. Each project group will consist of maximum of two students The Student shall undertake minor project- I depending on the electives studied in the previous semesters / Research based / Industry Oriented Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey						
2. Allocation of the guides preferably in accordance with the expertise of the faculty						
3. The number of projects that a faculty can guide would be limited to six						
4. The minor project would be performed in-house						
The implementation of the project must be preferably carried out using the resources available in the department/college						
<b>Course Outcomes</b>						
After going through this course the students will be able to						
<b>CO1:</b> Conceptualize, design and implement solutions for specific problems						
<b>CO2:</b> Communicate the solutions through presentations and technical reports						
<b>CO3:</b> Apply resource managements skills for projects						
<b>CO4:</b> Synthesize self-learning, team work and ethics						
<b>Scheme of Continuous Internal Examination (CIE)</b>						
Evaluation of the project work will be done by the committee appointed by the director, Dept of MCA. The student should submit report on the mini project work. Evaluation will be carried out in THREE Phases.						
<b>Phase</b>	<b>Activity</b>					<b>Weightage</b>
<b>I</b>	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation					10%
<b>II</b>	Mid-term seminar to review the progress of the work and documentation					25%
	<ul style="list-style-type: none"> <li>• Design and Simulation / Algorithm development / Experimental Setup</li> <li>• Conducting experiments / Implementation / Testing</li> </ul>					
<b>III</b>	Oral presentation					10%
	Demonstration					20%
	Project report					10%
<b>Scheme for Semester End Examination (SEE)</b>						
The evaluation will be done by Internal and External examiners. The following weightage would						

be given for the examination. Evaluation will be done in batches of 10 students.

- |  |     |
|--|-----|
| 1. Brief write-up about the project                  | 05% |
| 2. Presentation / Demonstration of the project       | 20% |
| 3. Methodology and Experimental Results & Discussion | 25% |
| 4. Report  | 20% |
| 5. Viva Voce   | 30% |

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	H	-	-	M	-	H	H	
CO2	-	-	-	-	H	-	-	H	H	H	-	
CO3	H	H	M	-	M	M	H	H	-	M	H	
CO4	-	H	-	-	-	H	M	M	M	H	-	

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	M
CO2	-	L
CO3	-	M
CO4	M	M

**H-High, M-Medium, L-Low**

## V Semester

<b>DATA ANALYTICS (Theory &amp; Practice)</b>					
<b>Course Code</b>	:	<b>16MCA51</b>	<b>CIE Marks</b>	:	<b>100+50</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S : 4:0:2:0</b>	<b>SEE Marks</b>	:	<b>100+50</b>
<b>Credits</b>	:	<b>5</b>	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Explore the fundamental concepts of data analytics					
2. Understand the applications using Map Reduce Concepts					
3. Introduce programming tools PIG & HIVE in Hadoop echo system					
4. Understand the various search methods and visualization techniques					
<b>Unit – I</b>					<b>10 Hrs</b>
<b>Hadoop Fundamentals</b>					
Data, Data Analysis and storage, Comparison with other systems – Relational Database Management Systems, Grid Computing, Volunteer Computing, History of Apache Hadoop					
<b>The Hadoop Distributed File system</b>					
The Design of HDFS, HDFS Concepts – Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability,					
The command-Line Interface, Hadoop File system – Interfaces					
The Java Interface – Reading data from Hadoop URL, Reading Data using File system API, Writing Data, Directories, Querying the File system, Deleting Data					
Data Flow – Anatomy of a File Read, Anatomy of a File Write, Coherency Model					
Parallel Copying with distcp – Keeping an HDFS cluster Balanced					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Map Reduce – A Weather Dataset – Data format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out</b>					
<b>Working of Map Reduce – Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort, Task Execution</b>					
<b>Map Reduce Formats – Input Formats, Output Formats</b>					
<b>Unit – III</b>					<b>09 Hrs</b>
<b>Pig Environment – Execution types, Running Pig programs, Grunt, Pig Latin Editors</b>					
<b>An Example – Generating Examples, Comparison with databases</b>					
<b>Pig Latin – Structure, Statements, Expressions, Types, Schemas, Functions, Macros</b>					
<b>User-Defined Functions – A Filter UDF, An Eval UDF, A Load UDF</b>					
<b>Data Processing Operators – Loading and storing of data, Filtering data, Grouping and Joining data, Sorting data, Combining and splitting data</b>					
<b>Pig in Practice– Parallelism, Anonymous Relations, Parameter Substitution</b>					
<b>Unit – IV</b>					<b>09 Hrs</b>
<b>Installing Hive – The Hive shell, An Example; Running Hive – Configuring hive, Hive services, the</b>					



Meta store	
<b>Comparison with Traditional Databases</b> – Schema on Read Versus Schema on Write, Updates, Transactions and Indexes, SQL-on-Hadoop Alternatives	
<b>Hive QL</b> – Data Types, operators and functions	
<b>Tables</b> – Managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables, Dropping Tables	
<b>Querying Data</b> – Sorting and Aggregating, Map Reduce scripts, Joins, Sub queries, Views	
<b>Unit – V</b>	<b>10 Hrs</b>
<b>Data Visualization – I</b> – Introduction, Techniques used for visual data representation, Types of data visualization, Applications of data visualization, visualizing big data, Tools used in data visualization, tableau products	
<b>Data Visualization with Tableau</b> – Introduction to tableau software, tableau desktop workspace, Data analytics in tableau public, Using visual controls in tableau public	
<b>Unit – VI (Lab Component)</b>	
<b>PART A</b>	
<b>1 --- HDFS</b>	
Review the commands available for the Hadoop Distributed File System:	
<ol style="list-style-type: none"> <li>1. Copy file foo.txt from local disk to the user’s directory in HDFS</li> <li>2. Get a directory listing of the user’s home directory in HDFS</li> <li>3. Get a directory listing of the HDFS root directory</li> <li>4. Display the contents of the HDFS file user / fred / bar.txt</li> <li>5. Move that file to the local disk, named as baz.txt</li> <li>6. Create a directory called input under the user’s home directory</li> <li>7. Delete the directory input old and all its contents</li> <li>8. Verify the copy by listing the directory contents in HDFS</li> </ol>	
<b>2 --- Map Reduce</b>	
<ol style="list-style-type: none"> <li>1. Create a Job and submit to cluster</li> <li>2. Track the job information</li> <li>3. Terminate the job</li> <li>4. Counters in MR Jobs</li> <li>5. Listing of Jobs</li> </ol>	
<b>3 --- Pig</b>	
Using movie lens data	
<ol style="list-style-type: none"> <li>1. List all the movies and the number of ratings</li> <li>2. List all the users and the number of ratings they have done for a movie</li> <li>3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)</li> <li>4. List all the Users who have rated the movies (Users who have rated at least one movie)</li> <li>5. List of all the User with the max, min, average ratings against movies</li> </ol>	
<b>4. Advanced Concepts in Pig</b>	
<ol style="list-style-type: none"> <li>1. Group by movie and dump the result in a bag.</li> </ol>	

2. Write a pig script to find the sum of ratings of all movies
3. Write a pig script to find the total ratings done by all user to a movie and store the results in an output file in HDFS

### 5 – Extracts facts using Hive

Use movies lens data with added attributes Genre\_id and Activity state column, perform the following queries using HiveQL. The Activity\_State and Gener\_id are as follows

Activity_State	Gener_id
1. RATE_MOVIE	1.ADVENTURE
2. COMPLETED_MOVIE	2.ANIMATION
3. PAUSE_MOVIE	3.COMEDY
4. START_MOVIE	4.DRAMA
5. BROWSE_MOVIE	5.ACTION
6. LIST_MOVIE	6.THRILLER
7. SEARCH_MOVIE	7.CRIME
8. INCOMPLETE_MOVIE	8.HORROR
	9.MYSTERY
	10.WAR

1. Write a query to select only those values which correspond to starting, browsing, completing, or Use a CASE statement to transform the RECOMMENDED column into integers where ‘Y’ is 1 and ‘N’ is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
  2. Write a query to select the User ID, movie ID, movie name for the activity COMPLETED\_MOVIE.
  3. Create the staging table
  4. Load the results of the query 1 into the staging table
- 6. Consider the superstore data set** <https://community.tableau.com/docs/DOC-1236>
- a. Build a Bar Chart that displays total sales over four year period
  - b. Add totals to show the stacked bars
  - c. Build a bar chart view that displays a list of technology products and how much profit each has generated.

**PART –B**

All the Programs should be executed using R

1. **Build a word cloud using text mining tools.**
  - Read a text file
  - Create a corpus from the collection of text files
  - Data Processing on the text files
  - Convert the text file into term document matrix and create a data frame
  - Making the word cloud
2. **Social Network Analysis and Visualization**
  - Create a graph and plot the graph
  - Show the various centrality scores such as degree, between's, closeness, Transitivity
  - Show Neighbourhood of graph vertices
  - Find Cliques
  - Display maximal connected components of a graph
  - Calculate cohesive blocks
3. **Sentiment Analysis for products reviews using Customer Feedback**
  - Load the required data set
  - Perform stemming and cleaning
  - Display the sentiment score for Neutral, Positive polarity and Negative Polarity

**Expected Course Outcomes**

After going through this course, the students will be able to

**CO1:** Understand the fundamentals of data analytics techniques and platforms

**CO2:** Design and Apply data analytics ecosystem and visualization techniques to solve various problems

**CO3:** Analyze the results of data analytics and visualization for various problems

**CO4:** Evaluate the solutions of data analytics ecosystems

**Reference Books**

1	Tom White, "Hadoop – The Definitive Guide; Storage and Analysis at Internet scale", O'Reilly, Shroff Publishers & Distributers Pvt. Ltd., 4 <sup>th</sup> Edition, 2015, ISBN – 978-93-5213-067-2.
2	DT Editorial Services "Big Data – Black Book" Dreamtech Press, Edition – 2015, ISBN - 978-93-511-9-757-7.
3	Dirk deRoos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, Rafael Coss "Hadoop for Dummies", John Wiley & Sons, Inc., 2014 ISBN: 978-1-118-60755-8 (pbk); ISBN 978-1-118-65220-6 (ebk); ISBN 978-1-118-70503-2 (ebk).
4	Nathan Marz and James Warren,"Big Data Principles and Best Practices of Scalable Real time data systems", 2015, ISBN 9781617290343.

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage of Part A is 70% and Part B weightage is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	L	-	L	L	-	-	-	-
CO2	H	M	L	M	M	-	-	-	-	-	-	-
CO3	H	H	L	M	M	-	-	-	-	-	-	-
CO4	H	M	L	M	L	-	-	-	-	-	-	-

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	M	M
CO2	H	M
CO3	M	M
CO4	H	M

**H –High, M-Medium, L-Low**

## V Semester

**Elective V**  
**Cloud Computing**  
**(Theory and Practice)**

<b>Course Code</b>	<b>:</b>	<b>16MCA521</b>	<b>CIE Marks</b>	<b>:</b>	<b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	<b>:</b>	<b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b>	<b>:</b>	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
<ol style="list-style-type: none"> <li>1. Familiarize the basic concepts of Infrastructure, Platform and Software services</li> <li>2. Understand the working of various applications, models and frameworks</li> <li>3. Explore the virtualization concepts in the various cloud resource</li> <li>4. Explore the various security and security risks in the cloud environment</li> </ol>					
<b>Unit – I</b>					<b>10Hrs</b>
<b>Introduction to Cloud Computing:</b> Defining cloud computing, cloud types, The NIST model, The cloud cube model, deployment models, Service models, Examining the characteristics of cloud computing, paradigm shift benefits of cloud computing, disadvantages of cloud computing, Assessing the role of open Standards, Assessing the value proposition, measuring the cloud's value, early adopters and new applications, the laws of cloudonomics, cloud computing obstacles, behavioural factors relating to cloud adoption, measuring cloud computing costs, avoiding capital expenditures, right-sizing computing the total cost of ownership, specifying service level agreements, defining licensing models					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Cloud Infrastructure-</b> Cloud Computing at Amazon, Cloud Computing: the Google Perspective, Microsoft Window Azure and Online Services, Open-Source Software Platform for Private Clouds, Cloud Storage Diversity and Vendor Lock-in, Cloud Computing Interoperability: The Intercloud, Energy Use and Ecological Impact of large-Scale Data Center, Service- and Compliance-Level Agreements, Responsibility Sharing Between User and Cloud Service Provider					
<b>Unit – III</b>					<b>08 Hrs</b>
<b>Cloud Computing: Applications and Paradigms-</b> Challenges for cloud computing, Existing cloud applications and new application opportunities, Architectural styles for cloud applications, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The ZooKeeper, The MapReduce programming model, A case study: The <i>GrepTheWeb</i> application					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Cloud Resource Virtualization-</b> Virtualization, Layering and Virtualization, Virtual Machine Monitors, Virtual Machines, Performance and Security Isolation, Full Virtualization and Para Virtualization, Hardware Support for Virtualization, Case Study: Xen, a VMM Based on Para virtualization, Optimization of Network Virtualization in Xen2.0, vBlades: Para virtualization Targeting an x86-64 Itanium Processor, A Performance Comparison of Virtual Machines, The Darker Side of Virtualization					

<b>Unit – V</b>		<b>10 Hrs</b>
<p><b>Cloud Security-</b> Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, Xoar: Breaking the monolithic design of the TCB, A trusted virtual machine monitor</p>		
<b>Unit – VI (Lab Component)</b>		
<b>Part – A</b>		
<ol style="list-style-type: none"> <li>1) Deploy an image into cloud using manual and command prompt method.</li> <li>2) Launch multiple instances using manual and command prompt method.</li> <li>3) Deploy the virtual drive in individual Virtual Machine for storage purpose.</li> <li>4) Create multiple Virtual Machines to communicate through SSH.</li> <li>5) Create a new user and grant the privilege to assign project in the cloud environment.</li> </ol>		
<b>Part – B</b>		
<ol style="list-style-type: none"> <li>1) Demonstrate Live Migration of Virtual Machine in Cloud.</li> <li>2) Analyze the status of VMs during down time in Live Migration.</li> <li>3) Create a new instance and associate the instance with floating IP address.</li> <li>4) Deploy the network with Virtual Local Area Network in cloud.</li> <li>5) Create a multiple router to communicate with each other by deploying in two different networks.</li> </ol>		
<p><b>Note: Students can use Openstack to execute the programs</b></p>		
<p><b>Expected Course Outcomes</b></p> <p>After going through this course the student will be able to</p> <p><b>CO1:</b> Understand the fundamental concepts of cloud computing environment</p> <p><b>CO2:</b> Identify the various key enabling technologies for cloud computing</p> <p><b>CO3:</b> Apply various programming models to cloud applications</p> <p><b>CO4:</b> Compare the different cloud platforms to the cloud computing scenarios</p>		
<b>Reference Books</b>		
1.	Barrie Sosinsky, “Cloud Computing” Wiley Publishing Inc., 2011, ISBN: 978-0-470-90356-8.	
2.	Dan. C. Marinescu,“ Cloud Computing Theory and Practice”, 2016,Morgan Kaufmann Publication, ISBN: 978-93-5107-094-8.	

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage for Part A is 70% and weightage for Part B is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	H	L	--	L	--	--	M	--	M	M	L	M
<b>CO2</b>	L	M	M	--	--	--	H	L	--	L	--	M
<b>CO3</b>	M	L	--	M	--	--	L	M	M	--	L	L
<b>CO4</b>	M	H	L	--	--	--	M	L	L	L	M	--

**Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
<b>CO1</b>	H	M
<b>CO2</b>	M	-
<b>CO3</b>	L	H
<b>CO4</b>	-	L

**H –High, M-Medium, L-Low**

## V Semester

<b>Elective V Virtual Reality (Theory and Practice)</b>					
<b>Course Code</b>	:	<b>16MCA522</b>	<b>CIE Marks</b>	:	<b>100+50</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b>	:	<b>100+50</b>
<b>Credits</b>	:	<b>5</b>	<b>SEE Duration</b>	:	<b>3 Hours</b>
<b>Course Learning Objectives (CLO)</b>					
<b>Graduates shall be able to</b>					
1. Explain the concepts and principles of Virtual Reality					
2. Understand the nuances of designing for VR					
3. Explore the Fundamental issues of Virtual Reality					
4. Learn how to build VR applications in real World					
<b>Unit – I</b>					<b>8 Hours</b>
<b>Introduction:</b> What is Virtual Reality? Virtual Reality Applications.					
<b>Virtual Reality Hardware:</b> Oculus Rift, Other High End Head Mounted Displays, Gear VR, Google Cardboard, VR Input Devices.					
<b>Birds - Eye View:</b> General Hardware, software, sensation and perception.					
<b>Objects and Scale:</b> Getting started with Unity- Starting a new Unity project, The Unity editor, The default world space. Creating a simple diorama- Adding a cube, Adding a plane, Adding a sphere and some material, Changing the scene view, Adding a photo, Colouring the ground plane.					
<b>Unit – II</b>					<b>10 Hours</b>
<b>Objects and Scale:</b> Measurement Tools- Keeping a unit cube handy, Using a Grid Projector, Measuring the Ethan character. Importing from the Blender Experiment: An introduction to Blender- A unit cube, A UV Texture image, Importing into Unity. VR device integration software- Unity's built-in VR support, The device-specific SDK.					
<b>Geometry of Virtual Worlds:</b> Geometric modelling, Transformation models, Matrix Algebra and 2D rotations, 3D rotations and Yaw, pitch and roll.					
<b>Unit – III</b>					<b>8 Hours</b>
<b>Physics and the Environment:</b> Unity physics, Bouncy balls					
<b>Interlude – environment and things:</b> Blender, An Elevator, Jumping.					
<b>Gaze-based Control:</b> Ethan, the walker- Artificially intelligent Ethan, The Navmesh bakery, A random walker in the town, Interlude – a quick introduction to Unity programming, The Random Position script, "Zombie-ize" Ethan. Go where I'm looking- The Look Move To script, Adding a feedback cursor, Observations. If looks could kill- The Kill Target script, Adding particle effects, Cleaning up.					
<b>Unit – IV</b>					<b>12 Hours</b>
<b>Visual Rendering:</b> Visual rendering overview, Ray Tracing and Shading Models, Rasterization, VR –Specific problems.					
<b>Tracking:</b> Tracking 2D and 3D orientation, tracking with a camera.					



Unit – V	10 Hours
<p><b>First-person Character:</b> Understanding the Unity characters - The Camera component, The Rigid body component, The Character Controller component, Unity Standard Assets- Third Person Controller, AI Third Person Controller, First Person Controller, Rigid Body FPS Controller. Making a first person, User calibrations, Maintaining a sense of self, Locomotion, teleportation and sensors, Managing VR motion sickness</p>	
<p><b>Unit – VI (Lab Component)</b></p>	
<p><b>Part – A</b></p>	
<ol style="list-style-type: none"> <li>1. Create a 3D object and Apply different geometric Transformations using Mouse/Keyboard</li> <li>2. Create animation for a 3D object(transformation, color, texture, ect)</li> <li>3. Bouncing ball on multiple 2D / 3D platforms</li> <li>4. Develop First Person Controller to a Scene</li> <li>5. Create a 3D Character movement</li> <li>6. Create a menu driven interface for adding and removing objects from a Scene</li> <li>7. Build a cubic room, whose sides are made out of six planes. The room should be 15x15x15 Unity units. At the center of the roof of the room, place a point source of light. This light should change color by pressing the Tab key.</li> <li>8. Finding target using 2D Raycaster</li> <li>9. Create a loading bar (health bar, progress bar, start bar)</li> <li>10. Create and show motion effect using time scale and scripts for 2D images.</li> </ol>	
<p><b>Part – B</b></p>	
<ol style="list-style-type: none"> <li>1. Design and Development of Simple VR Game               <ol style="list-style-type: none"> <li>a. Action Games</li> <li>b. Racing</li> </ol> </li> <li>2. Design and Development of Story Telling               <ol style="list-style-type: none"> <li>a. Moral Stories</li> <li>b. Fiction Stories</li> </ol> </li> <li>3. Design and Development of Virtual Tour               <ol style="list-style-type: none"> <li>a. Forest / Zoo</li> <li>b. Solar System</li> </ol> </li> <li>4. Design and Development of Medical Application               <ol style="list-style-type: none"> <li>a. Animate different Organs</li> <li>b. Influence of viruses on human body</li> </ol> </li> <li>5. Design and Development of Building Structure</li> </ol>	
<p><b>Note:</b> Students should complete all programs of Part – A and any one program from Part –B using Unity tool. In the examination each student will pick one question from Part –A for execution and demonstrate one program from Part –B</p>	

**Expected Course Outcomes**

After going through this course the student will be able to:

CO1 : Understand the concepts of Virtual Reality and its Applications

CO2: Discuss the Principles of Virtual Reality

CO3: Demonstrate a virtual environment to captivate its experiences

CO4: Analyze the fundamental issues of virtual reality

**Reference Books:**

1	Tony Parisi, "Learning Virtual Reality, Developing Immersive Experiences and Applications for Desktop, Web and Mobile", 1 <sup>st</sup> edition, 2015, O'Reilly Media, Inc., ISBN-13: 978-93-5213-257-7.
2	Jonathan Linowes, "Unity Virtual Reality Projects", 1 <sup>st</sup> edition, 2015, Packt Publishing Ltd., ISBN 978-1-78398-855-6.
3	Steven M La Velle, "Virtual Reality", copy right Steven M La Valle, 2017.

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Scheme of Semester End Examination (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage for Part A is 70% and weightage for Part B is 30%. One question from Part A to be executed and one from Part B to be demonstrated. Change of program is not permitted.

**Mapping of Course Outcome (CO) to Program Outcome (PO)**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L	L	M	L	-	-	-	-	-	-
CO2	H	M	M	L	M	-	-	-	L	-	L	-
CO3	-	-	H	L	H	-	-	M	M	-	L	-
CO4	-	L	L	H	L	-	-	-	L	-	-	-

<b>Mapping of Course Outcome to Program Specific Outcome (PSO)</b>		
	PSO1	PSO2
CO1	L	L
CO2	L	L
CO3	H	H
CO4	M	H
H –High, M-Medium, L-Low		

## V Semester

<b>Elective V</b>			
<b>Internet of Things</b>			
<b>(Theory and Practice)</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA523</b>	<b>CIE Marks</b> : <b>100+50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:2:0</b>	<b>SEE Marks</b> : <b>100+50</b>
<b>Credits</b>	<b>:</b>	<b>5</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
<ol style="list-style-type: none"> <li>1. Learn the basics of Internet of Things and its applications</li> <li>2. Understand IoT principles, design and abstraction of developing IoT systems</li> <li>3. Work with various sensors and actuators</li> <li>4. Setup IoT connectivity using dashboards</li> </ol>			
<b>Unit – I</b>			<b>8Hrs</b>
<b>Introduction to Internet of Things:</b>			
Fundamentals of Electronics and sensors for Internet of Things. Internet of Things Applications and Use cases, Network and Communication, Standards related to Internet of Things, Protocols in Internet of things			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>Programming with Arduino:</b> Understanding the eco system of arduino, Pinout configuration, Digital input and output, Analog input and output, working with sensors and actuators. Arduino serial communication. Communication interfaces (SPI and I2C) wired and wireless communication with arduino and sensor data logging from arduino.			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>Programming with Raspberry Pi:</b> Understanding the eco system of Raspberry Pi3, Pinout configuration, Digital input and output, working with sensors and actuators. Raspberry Pi serial communication. Communication interfaces (SPI and I2C) wired and wireless communication with raspberry Pi. Serial communication from raspberry Pi to arduino.			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Programming with esp8266 (nodemcu):</b> Understanding the eco system of esp8266, pinout configuration, Digital, Analog input and output, working with sensors and actuators. Serial communication from raspberry Pi to nodemcu, Network configuration on esp8266, wired and wireless communication with nodemcu			
<b>Unit – V</b>			<b>10 Hrs</b>
<b>IoT Application Development and Integrating sensors with IoT Dashboards</b>			
NodeJS/Django Based web application development to monitor and control IoT devices. Integration of Adafruit / Thinksboard and similar tools with sensors and actuators.			

### Unit – VI(Lab Component)

#### Part – A

1. Write a program with Arduino UNO board to calculate the distance of a obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain value turn on a buzzer / beeper with a LED in ON state and display the distance in LCD / OLED.
2. Write a program with Arduino UNO to indicate the level of temperature using the LEDs indicating the low, medium and high values of temperature ( Red, Blue and Green ) or Write a program with Arduino UNO to implement the interactive traffic signal.
3. Write a interactive python script on Raspberry Pi3 to implement the serial communication from Raspberry Pi to Arduino and vice versa with the following components.  
a) LED b) Buzzer c) Temperature and humidity sensor b ) four channel relay
4. Write a python script on Raspberry pi to control servo motor and DC Motor based on the potentiometer meter and button switch inputs. Also, indicate the angle of the servo motor and change the color of RGB Led/Bulb.
5. Write a micro python script with esp8266 based nodemcu board to calculate the distance of an obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain. value turn on buzzer / beeper with a LED in ON state and display the distance in LCD/ OLED.
6. Write a micro python script with esp8266 based nodemcu board to operate a 4 channel relay demonstrating minimal home automation.

#### Part – B

1. Integrate dashboard like Blynk /Adafruit /gobot /Thingsboards to any of the experiments in PART A.

*Note : nodemcu with lua and 4 channel relay can be used instead of micropython*

2. Integrate Blynk / gobot / Thingsboard dashboard with arduino or Raspberry pi or nodemcu and proximity and ultrasonic sensor.
3. Develop a django dashboard to monitor and control the sensor and actuators used in PART A.
4. Develop a javascript based application to monitor power and water consumption with billing.

#### Expected Course Outcomes

At the end of the course the student will be able to

**CO1:** Understand the architecture of Arduino, Raspberry Pi, nodemcu, arduino IDE, frameworks.

**CO2:** Differentiate between various development boards, sensors and actuators, install NOOBS Ubuntu IoT Operating System and setup Raspberry PI, Arduino and nodemcu.

**CO3:** Interacting with Arduino, Raspberry Pi and Nodemcu using python, JavaScript.

**CO4:** Learn and Implement various IoT solutions practically.

#### Reference Books

1. Wizardr, “Exploring Arduino: Tools and Techniques for Engineering” 1<sup>st</sup> Edition Wiley, ISBN-10: 1118549368, ISBN-13: 978-1118549360.
2. Derek Molloy, “Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux” 1<sup>st</sup> Edition, Wiley ISBN-13: 978-1119188681, ISBN-10: 1119188687.
3. Marco Schwartz, ” Internet of Things with ESP8266 “, 2016, Packt.

4. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands-on Approach", 2015, Orient Blackswan Pvt Ltd, ISBN : 8173719543.
5. Dominique D. Guinard & Vlad M. Trifa, "Building the Web of Things", Manning, ISBN 9781617292682.

#### **Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

#### **Scheme of Continuous Internal Evaluation (CIE) for Practical**

CIE for the practical will be based on the performance of the student in the laboratory every week for 10 marks for every experiment. Finally, the weekly evaluated marks will be consolidated for 40 marks. One test will be conducted at the end of the semester for 10 marks. The total marks for CIE (Practical) will be for 50 marks. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

#### **Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

#### **Scheme of Semester End Examination (SEE) for Practical**

The total marks for SEE (Practical) will be 50 marks. Evaluation of SEE for the practical will be based on writing proper program, execution, proper results and viva voce. Weightage for Part A is 70% and Part B is 30%. One question from Part A and one from Part B need to be executed. Change of program is not permitted.

#### **Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	--	L	L	--	M	--	M	M	L	--
CO2	L	M	M	--	L	--	H	L	--	L	--	--
CO3	M	M	M	M	M	--	M	--	--	--	--	--
CO4	M	H	H	M	H	L	M	L	L	L	M	M

#### **Mapping of Course Outcomes(CO) to Program Specific Outcomes(PSO)**

	PSO1	PSO2
CO1	-	-
CO2	L	L
CO3	M	M
CO4	H	M

**H –High, M-Medium, L-Low**

<b>V Semester</b>					
<b>Elective VI</b>					
<b>Distributed and Parallel Computing</b>					
<b>Course Code</b>	:	<b>16MCA531</b>	<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:0:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>4</b>	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives:</b>					
Graduates shall be able to					
1. Gain basic understanding of fundamental concepts of distributed and parallel computing					
2. Be able to identify and leverage common distributed and parallel computing patterns					
3. Be able to properly assess efficiency and scalability of a distributed and parallel algorithm/application					
4. Become proficient in using different programming techniques to implement basic distributed and parallel computing paradigms					
<b>Unit – I</b>					<b>10 Hrs</b>
<b>Introduction to Distributed Computing</b> – Introduction, Definition, Goals of Distributed systems, Issues to Distributed systems, Types of Distributed Systems, Distributed System Models, Models of Middle ware					
<b>Introduction to Parallel Computing</b> –Introduction, Computing, Parallel Architecture, Classification based on architectural scheme, Classification based on Memory access, Performance Metrics, Parallel Programming models, Serial and Parallel Algorithms, Parallelism					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Communication:</b> Introduction, Layered protocols, Remote Procedure Calls, Remote Object Invocation, Remote Method Invocation, Message Oriented Communications, Stream Oriented Communications					
<b>Resource Management:</b> Resource management in Distributed system, Desirable Features of Global Scheduling algorithm, Scheduling in Distributed system, Load Balancing approach in distributed system, Load Sharing Approach					
<b>Unit – III</b>					<b>10 Hrs</b>
<b>Synchronization, Replication and Distributed File System (Distributed Computing )</b>					
Introduction, Clock Synchronization, Physical clock, Logical clock, Election Algorithms, Mutual Exclusion, Centralised algorithm, Distributed Mutual Exclusion					
<b>Replication and Distributed File System</b>					
Replication Management , Distributed File system , Case studies					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Distributed Memory Programming with MPI (Parallel Computing )</b>					
Getting Started, Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived data types, Performance Evaluation of MPI programs, A parallel sorting algorithm					
<b>Unit – V</b>					<b>08 Hrs</b>

<b>Shared Memory programming with Open MP(Parallel Computing )</b>												
Getting Started, Trapezoidal Rule, Scope of Variables, Reduction Clause - Parallel for directive, More about Loops in openMP, Scheduling loops.												
<b>Expected Course Outcomes</b>												
After going through this course the students will be able to												
<b>CO1:</b> Realize the need of distributed and parallel computing systems and techniques												
<b>CO2:</b> Summarize the techniques to handle components of distributed and parallel computing												
<b>CO3:</b> Apply different management (Communication, Resource, Memory, File) techniques to handle distributed and parallel mechanism												
<b>CO4:</b> Evaluate the metrics and performance of the serial, distributed and parallel programs												
<b>Reference Books</b>												
1	Arun Kulkarni, Nupur Prasad Giri, Nikeshi Joshi, Bhushan Jadhav, “Parallel and Distributed Systems”, 2 <sup>nd</sup> Edition, Wiley Publication, 2017, ISBN: 978-81-265-6582-5.											
2	Peter S Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann Publishers – 2014, ISBN : 978-93-80931-75-3.											
3	Sunita Mahajan and Seema Shah, “Distributed Computing “, Second Edition, Oxford University Press, ISBN-10: 0198093489, ISBN-13: 9780198093480.											
4	Albert Y. Zomaya, Editor, “Parallel and Distributed Computing Handbook “,McGraw-Hill, ISBN-13: 978-0070730205 , ISBN-10: 0070730202.											
<b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b>												
CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.												
<b>Scheme of Semester End Examination (SEE) for Theory</b>												
The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	H	M	M	H	L	-	L	-	-	-	L	-
<b>CO2</b>	H	H	M	L	M	-	L	L	-	-	L	-
<b>CO3</b>	M	M	H	H	H	-	L	-	L	-	-	-
<b>CO4</b>	H	H	H	H	H	-	L	-	L	-	L	-
<b>Mapping of Course Outcome to Program Specific Outcome</b>												
	<b>PSO1</b>						<b>PSO2</b>					
<b>CO1</b>	H						L					
<b>CO2</b>	H						M					
<b>CO3</b>	M						H					
<b>CO4</b>	M						H					
<b>H-High, M-Medium, L-Low</b>												



## V Semester

<b>Elective – VI</b>			
<b>Service Oriented Architecture</b>			
<b>Course Code</b>	<b>:</b>	<b>16MCA532</b>	<b>CIE Marks</b> : <b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:0:0</b>	<b>SEE Marks</b> : <b>100</b>
<b>Credits</b>	<b>:</b>	<b>4</b>	<b>SEE Duration</b> : <b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>			
Graduates shall be able to			
1. Identify all fundamental concept of Service-Orientation.			
2. Analyze basic Principles of service –Composibility.			
3. Use and compare different Service Technology.			
4. Apply concurrency, synchronization techniques to develop J2EE and .NET real world applications.			
<b>Unit – I</b>			<b>10 Hrs</b>
<b>An Overview of SOA &amp; Service-Orientation:</b> Services and Service-Orientation, Service-Orientation, Yesterday and Today, Applying Service-Orientation, The Eight Principles of Service-Orientation, The Four Characteristics of SOA, The Four Common Types of SOA, SOA Design Patterns.			
<b>Unit – II</b>			<b>10 Hrs</b>
<b>A Look at How Services are Defined and Composed:</b> Basic Concepts, Agnostic and Non-Agnostic Logic, Service Models and Service Layers, Service and Service Capability Candidates, Breaking Down the Business Problem, Functional Decomposition, Service Encapsulation, Agnostic Context, Agnostic Capability, Utility Abstraction, Entity Abstraction, Non-Agnostic Context, Process Abstraction and Task Services.			
<b>Unit – III</b>			<b>10 Hrs</b>
<b>An Overview of Service Technology:</b> SOAP-Based Web Services, REST Services, Components, Service Virtualization, Cloud Computing, API Management, Model-Driven Software Design, Semantic Web, Business Process Management, Composition and Orchestration, Master Data Management, Business Rule Engines, Social Network Technologies, Mobile Computing, Agent-Driven Architecture, Event-Driven Architecture and Complex Event Processing.			
<b>Unit – IV</b>			<b>10 Hrs</b>
<b>Enterprise Applications:</b> Learning Objectives, Architectural Considerations, Solution Architecture for Enterprise Applications, Solution Architecture for Enterprise Applications based on SOA, Software Platforms for Enterprise Applications.			
<b>Unit – V</b>			<b>08 Hrs</b>
<b>A Case Study:</b> Systems Landscape, New Marketing Strategy, Corporate Culture, Vehicle Maintenance, The Billing System, Strategic Considerations, Cloud Adoption. New Reference Architecture, The Customer Profile Process.			

**Expected Course Outcomes**

After going through this course the students will be able to

**CO1:** Understand the basic concepts of Service Orientation.

**CO2:** Analyze the SOA Architectural style, SOA strategies, model web services

**CO3:** Design, implement process of SOA in web service.

**CO4:** Apply the SOA operational style for the web services.

**Reference Books**

1	Thomas Erl, "Next Generation SOA: A Concise Introduction to Service Technology & Service-Oriented Architecture", Pearson Education, 2014, 1 <sup>st</sup> Edition, ISBN-978-0133859041.
2	Shankar Kambhapaty, "Service –Oriented Architecture for Enterprise and Cloud Applications", 2 <sup>nd</sup> Edition, Wiley India, 2012, ISBN-978-81-265-1989-7.

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE) for Theory**

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	L	L	L	-	L	H	M	-	L	L
CO2	M	M	H	M	M	-	L	H	M	-	L	M
CO3	L	H	L	H	M	-	L	L	H	-	M	M
CO4	M	M	H	M	H	-	L	L	H	-	M	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	H
CO2	M	L
CO3	M	L
CO4	L	M

**H-High, M-Medium, L-Low**

## V Semester

**Elective VI**  
**Data Warehousing & Data Mining**

<b>Course Code</b>	: 16MCA533	<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	: L:T:P:S 4:0:0:0	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	: 4	<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>				
Graduates shall be able to				
1. Introduce the basic concepts of Data Warehouse and Data Mining techniques.				
2. Examine the types of the data to be mined and apply pre-processing methods on raw data.				
3. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.				
<b>Unit – I</b>				<b>10 Hrs</b>
<b>Introduction to Data Warehouse and OLAP Techniques:</b> Data Ware house, Basic Concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse -Design and Usage, Data Warehouse Implementation.				
<b>Unit – II</b>				<b>12 Hrs</b>
<b>Introduction to Data Mining:</b> Why Data Mining, What is Data Mining, What kinds of patterns can be mined, Which Technologies are used, Which kinds of applications are targeted, Major Issues in Data Mining.				
<b>Getting to Know Your Data and Data Pre-processing:</b> Data Objects and Attribute types, Measuring Data Similarity and Dissimilarity, Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction: Overview of Data Reduction Strategies, Principal Component Analysis, Attribute subset selection, Clustering, Sampling.				
<b>Unit – III</b>				<b>10 Hrs</b>
<b>Classification Basic Concepts:</b> Basic Concepts				
<b>Decision Tree Induction:</b> Decision tree induction , Attribute Selection Method ,Tree Pruning				
<b>Bayes Classification Methods:</b> Bayes Theorem ,Naïve Bayesian Classification				
<b>Rule Based Classification Techniques:</b> Using IF-Then Rules for classification, Rule Extraction from a Decision tree ,Rule Induction using sequential covering algorithm				
<b>Model Evaluation and Selection:</b> Metrics for evaluating a classifier performance, Hold Method and Random sampling, Cross Validation, Comparing classifiers based on Cost-Benefit and ROC Curves.				
<b>Unit – IV</b>				<b>08 Hrs</b>
<b>Association Mining Basic concepts:</b> Market Basket Analysis, Frequent Item sets, closed Item sets and Association Rules.				
<b>Frequent Item set Mining Methods:</b> Apriori Algorithm, Generating Association rule from frequent item sets , Improving the Efficiency of Apriori.				
<b>Pattern Evaluation Methods:</b> Strong rules are not necessarily Interesting, A comparison of Pattern evaluation methods.				
<b>Unit – V</b>				<b>08 Hrs</b>

**Cluster Analysis: Basic Concepts and Methods:** Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative v/s Divisive Hierarchical clustering , Distance measures in Algorithmic methods , Evaluation of Clustering

**Expected Course Outcomes**

**CO1:** Understand the components of data warehouse architecture and OLAP operations

**CO2:** Process raw data to make it suitable for various data mining algorithms

**CO3:** Apply Clustering, Classification, Rule mining algorithms to find patterns

**CO4:** Evaluate the different data mining algorithms using various metrics

**Reference Books**

1	Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining – Concepts and Techniques”, 3 <sup>rd</sup> Edition, Morgan Kauffmann Publications, 2012, ISBN: 978-93-80931-91-3.
2	Pang-Ning Tan, Michael Steinbach, Vipin Kumar , “Introduction to Data Mining”, Addison Wesley, 2008, ISBN:978-81-317-1472-0.
3	G K Gupta, “Introduction to Data Mining with Case Studies”, 2 <sup>nd</sup> Edition, PHI Learning Private Ltd, ISBN 978-81-203-4326-9.

**Scheme of Continuous Internal Evaluation (CIE) for Theory**

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE) for Theory**

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**Mapping of Course Outcome to Program Outcome**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	H	M	M	-	L	-	-	-	L	-
CO2	L	M	M	M	H	-	L	-	-	-	M	-
CO3	M	H	H	H	H	-	M	L	L	-	L	-
CO4	H	M	M	H	H	-	L	-	-	-	-	-

**Mapping of Course Outcome to Program Specific Outcome**

	PSO1	PSO2
CO1	M	L
CO2	M	L
CO3	H	M
CO4	L	L

**H-High, M-Medium, L-Low**

## V Semester

**Elective VII**  
**Wireless and Mobile Networks**

<b>Course Code</b>	<b>:</b>	<b>16MCA541</b>	<b>CIE Marks</b>	<b>:</b>	<b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	<b>:</b>	<b>100</b>
<b>Credits</b>	<b>:</b>	<b>4</b>	<b>SEE Duration</b>	<b>:</b>	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>					
Graduates shall be able to					
1. Explore the design issues in wireless networks.					
2. Understand wireless and mobile network and its applications in communication engineering					
3. Explore the various principles, concepts and design of wireless mobile communications.					
4. Analyse the architecture and protocols of wireless mobile networks					
<b>Unit – I</b>					<b>8 Hrs</b>
<b>Fundamentals of Wireless Communication:</b> Digital Communications, Wireless Communication System, Wireless Media, Frequency Spectrum, Technologies in Digital Wireless Communication, Wireless Communications Channel Specifications, Types of Wireless Communication Systems.					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>Basics of Wireless Networks:</b> Wireless Networks, Wireless Switching Technology, Wireless Network Reference Model.					
<b>Cellular Mobile Wireless Networks: System Design Fundamentals and Propagation Path Loss Models-</b> Description of Cellular Systems, Propagation Models for Wireless Networks- Free-space Propagation Model and Two-Ray Ground Reflection Model. Mobile Communication Antennas.					
<b>Unit – III</b>					<b>10 Hrs</b>
<b>Second-Generation Mobile Networks-GSM: Architecture and Protocols</b> –GSM Network Architecture, GSM Multiple Access Scheme, GSM Protocols and Signalling Authentication and Security.					
<b>3G-The Universal Mobile Telecommunication System (UMTS):</b> UMTS Network Architecture-Release, UMTS Interfaces, UMTS Networks Evolution, UMTS FDD and TDD, UMTS Channels, UMTS Network Protocol Architecture					
<b>Unit – IV</b>					<b>10 Hrs</b>
<b>Fundamentals of Wireless Local Area Networks:</b> IEEE 802.11, WLAN Transmission Technology, WLAN System Architecture, Collision Sense Multiple Access with Collision Detection: CSMA/CD, Collision Sense Multiple Access with Collision Avoidance: CSMA/CA					
<b>Future Trends: Fourth Generation (4G) system and Beyond:</b> Introduction, Design Goals for 4G and Beyond and related Issues – Orthogonal Frequency Division Multiplexing (OFDM), 4G Services and Applications, Challenges- Predicting the future of wireless Systems					

Unit – V												10 Hrs
<p><b>Security Issues in Wireless in Wireless System:</b> The Need for Wireless Security, attacks on Wireless networks, Wired Equivalent Privacy (WEP) Protocol</p> <p><b>Drivers for 5G: The ‘Pervasive Connected World’:</b> 5G Roadmap, 10 Pillars of 5G, <b>The 5G Internet:</b> Introduction, Internet of Things and Context-Awareness, Networking Reconfiguration and Virtualisation Support, Mobility, Quality of Service Control</p>												
<p><b>Expected Course Outcomes</b></p> <p>At the end of the course the student will be able to:</p> <p><b>CO1:</b> Understand the basic concepts and standards related to wireless mobile networks.</p> <p><b>CO2:</b> Explore various concepts and principles used in wireless network</p> <p><b>CO3:</b> Build knowledge upon architecture and protocols of wireless mobile networks</p> <p><b>CO4:</b> Analyze the design issues in wireless and mobile networks</p>												
<p><b>Reference Books:</b></p>												
1	Dr. SunilKumar S. Manvi, Mahabaleshwar S.kakkasageri, “Wireless and Mobile Networks: Concepts and Protocol”, Wiley India, ISBN: 978-81-265-2069-5, Reprint 2012											
2	Iti Saha Misra. <i>Wireless Communications and Networks: 3G and Beyond</i> . McGraw Hill Education (India) Pvt Ltd, ISBN – 13:978-0-07-015140-6, 2013.											
3	Georgios I. Papadimitriou, Andreas S. Pomportsis, P. Nicopolitidis, Mohammed S. Obaidat “Wireless Networks”, Publisher-John Wiley & Sons, ISBN- 0470858028, 2003											
4	Rodriguez, Jonathan, ed. Fundamentals of 5G mobile networks. Publisher- John Wiley & Sons, ISBN: 9781118867525, 2015											
<p><b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b></p> <p>CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.</p>												
<p><b>Scheme of Semester End Examination (SEE) for Theory</b></p> <p>The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.</p>												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	-	L	M	-	L	M	L	-	-	M	-	-
CO2	L	L	-	H	H	L	-	-	-	M	-	-
CO3	-	M	M	H	M	H	H	-	-	M	-	-
CO4	L	L	H	H	H	M	L	-	-	M	-	-
<p><b>Mapping of Course Outcome to Program Specific Outcome</b></p>												
CO\PSO	PSO1						PSO2					
CO1	M						H					
CO2	M						M					
CO3	L						H					
CO4	L						M					
<p><b>H –High, M-Medium, L-Low</b></p>												

## V Semester

## Elective VII

## Principles of UI / UX Design

<b>Course Code</b>	:	<b>16MCA542</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 4:0:0:0</b>		<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>4</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>						
Graduates shall be able to						
1. Understand the basics of user interface and user experience design						
2. Develop various design skills in UI and UX						
3. Evaluate quality of service in UI design / user experience process and technical documentation						
4. Establish individual and collaborative skills in design-based problem solving						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Introduction to User Interface Design Process:</b>						
<b>Usability of Interactive Systems:</b> Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Guideline, principles, and theories, <b>Managing Design Processes:</b> Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies, Ethnographic Observation, Participatory Design, Scenario Development						
<b>Unit – II</b>						<b>10 Hrs</b>
<b>Evaluating Interface Design: Introduction,</b> Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments. <b>Direct Manipulation and Virtual Environments:</b> Introduction, 3D Interfaces, <b>Menu Selection, Form Filling and Dialog Boxes:</b> Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry With Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays						
<b>Unit – III</b>						<b>10 Hrs</b>
<b>Quality of Service:</b> Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response time, <b>Balancing Function and Fashion:</b> Introduction, Error Messages, Non-anthropomorphic Design, Display design, Window Design, Colour. <b>Information Search:</b> Introduction, Search in Textual Documents and Database Querying, Multimedia document searches, advanced filtering and Search Interfaces						
<b>Unit – IV</b>						<b>08 Hrs</b>
<b>User Experience Design:</b> Introducing User Experience, From product design to user experience design, Designing for experience, User experience and the web, Building from bottom to top, Elements of user experience						
<b>Unit – V</b>						<b>10 Hrs</b>

<p><b>Strategy Plane:</b> Product Objectives, Business goals, Brand Identity ,Success Metrics and User Needs, User Segmentation, Usability and User Research, Creating Personas</p> <p><b>Surface Plane:</b> Sensory Design, Defining the Surface, Making Sense of the Senses, Contrast and Uniformity, Internal and External Consistency, Color Palettes and Typography, Design Comps and Style Guides.</p> <p><b>Case Study:</b> To explore the UI/UX using Wire framing /Prototyping tools</p>												
<p><b>Expected Course Outcomes</b></p> <p>After going through this course the student will be able to</p> <p><b>CO1:</b> Understand the theoretical foundations and awareness of User Interface and User Experience design</p> <p><b>CO2:</b> Identify and Apply various Design Skills in UI and UX for real world Applications</p> <p><b>CO3:</b> Demonstrate Quality of Service in UI Design strategies / Approaches and Technical documentation Process</p> <p><b>CO4:</b> Evaluate UI/UX design Process/ artifacts for building products</p>												
<p><b>Reference Books</b></p>												
1	Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface”, Pearson Education, 2014, 5 <sup>th</sup> Edition, ISBN-10: 9332518734, ISBN-13: 978-9332518735											
2	Jesse James, “The Elements of User Experience: User-Centred Design for the Web”, New Riders Publishers , 2 <sup>nd</sup> Edition, 2011, ISBN-10: 0321683684 ISBN-13: 978-0321683687.											
3	Bill Buxton , “Sketching User Experiences: Getting the Design Right and the Right Design” , Morgan Kaufmann, 2007, ISBN-10: 0123740371 ISBN-13: 978-0123740373.											
4	Jeffrey Rubin, Dana Chisnell, “Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests”, Wiley India Private Limited, 2 <sup>nd</sup> edition, 2008 ISBN-10: 8126516909, ISBN-13: 978-8126516902.											
<p><b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b></p> <p>CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.</p>												
<p><b>Scheme of Semester End Examination (SEE) for Theory</b></p> <p>The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom’s taxonomy level.</p>												
<p><b>Mapping of Course Outcomes (CO) to Program Outcomes (PO)</b></p>												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	L	M	M	-	L	-	L	L	L	-
CO2	M	M	M	L	L	-	M	-	M	L	M	-
CO3	M	L	M	L	L	-	L	-	M	-	M	-
CO4	M	M	M	M	M	-	M	-	M	-	M	-
<p><b>Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)</b></p>												
	PSO1						PSO2					
CO1	M						H					
CO2	M						H					
CO3	L						M					
CO4	M						M					



**H –High, M-Medium, L-Low**

### V Semester

#### Elective VII Soft Computing

<b>Course Code</b>	<b>:</b>	<b>16MCA543</b>		<b>CIE Marks</b>	<b>:</b>	<b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S 4:0:0:0</b>		<b>SEE Marks</b>	<b>:</b>	<b>100</b>
<b>Credits</b>	<b>:</b>	<b>4</b>		<b>SEE Duration</b>	<b>:</b>	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO)</b>						
Graduates shall be able to						
1. Understand the learning algorithms using neural networks.						
2. Differentiate between Classical Sets and Fuzzy Sets						
3. Apply fuzzy logic to solve real world problems.						
4. Apply genetic algorithm to solve optimization problems						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Artificial Neural Network:</b> Fundamental Concept – Artificial Neural Network, Biological Neural Network, Brain Vs Computer; Important Terminologies of ANNs – Weights, Bias, Threshold, Learning rate, Momentum Factor, Vigilance Parameter, Notations; Back Propagation Network-Theory, Architecture, Flow chart for Training Process, Training Algorithm, Learning Factors of Back Propagation Network, Testing Algorithm of Back Propagation Network, Radial Basis Function Network, Time Delay Neural Network.						
<b>Unit – II</b>						<b>10 Hrs</b>
<b>Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets:</b> Introduction to Fuzzy Logic, Classical Sets – Operators on classical sets, Fuzzy Sets- Fuzzy Set Operations, properties of Fuzzy Sets.						
<b>Classical Relations and Fuzzy Relations:</b> Introduction, Cartesian Product of Relation, Classical Relation – Cardinality of Classical Relation, Operations on Classical Relations, Properties of Crisp Relations, Composition of Classical Relations; Fuzzy Relations - Cardinality of Fuzzy Relation, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Composition.						
<b>Unit – III</b>						<b>10 Hrs</b>
<b>Member Functions:</b> Introduction, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Induction Reasoning.						
<b>Unit – IV</b>						<b>08 Hrs</b>
<b>Defuzzification:</b> Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods – Max-Membership Principle, Centroid Method, Weighted Average Method, Mean-Max Membership, Centre of Sums, Centre of Largest Area, First of maxima.						
<b>Unit – V</b>						<b>10 Hrs</b>

**Genetic Algorithms:** Biological Background – The Cell, Chromosomes, Genetics, Reproduction, Natural Selection; Traditional Optimization and Search Techniques – Gradient-Based Local Optimization Method, Random Search, Stochastic Hill Climbing, Simulated Annealing, Symbolic Artificial Intelligence; Genetic Algorithm and Search Space – Search Space, Genetic Algorithms World, Evolution and Optimization, Evolution and Genetic Algorithms, Basic Terminologies in Genetic Algorithm – Individuals, Genes, Fitness, Populations; Operators in Genetic Algorithm – Encoding, Selection, Crossover, Mutation; Stopping Condition for Genetic Algorithm Flow – Basic Individual, Worst Individual, Sum of Fitness, Median Fitness

### Expected Course Outcomes

After going through this course the students will be able to

**CO1:** Understand the fundamentals of Soft computing approaches and demonstrate the basic functionalities

**CO2:** Apply the soft computing techniques to solve problems

**CO3:** Analyze the results of soft computing techniques to handle various problems

**CO4:** Evaluate the solutions of soft computing algorithms for optimization

### Reference Books

1	S. N. Sivanandam, S. N. Deepa, "Soft Computing", Wiley Publishers, 2 <sup>nd</sup> Edition, 2015, ISBN – 978-81-265-2741-0.
2	B. K. Tripathy, J. Anuradha "Soft Computing Advances and Applications", 2015, Cengage Learning India Pvt Ltd, ISBN-13: 978-81-315-2619-4, ISBN-10: 81-315-2619-4.
3	Earl Gose, Richard Johnson Baugh, Steve Jost, "Pattern Recognition and Image Analysis", Pearson, 2015, ISBN: 978-93-325-4979-1.
4	James A. Anderson, "An Introduction to Neural Networks", Prentice Hall of India, ISBN-81-203-1351-8.

### Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be for 30 marks each, quiz and assignment for 10 marks each. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Semester End Examination (SEE) for Theory

The question paper will be for 100 marks and shall consist of 10 questions from five units with 20 marks each. Out of the 10 questions, students have to answer five questions from each unit. The questions will have Internal Choice with maximum 3 sub divisions. Both the questions shall be of the same complexity in terms of COs and Bloom's taxonomy level.

### Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	L	-	L	L	-	-	-	-
CO2	H	M	L	M	M	-	-	-	-	-	-	-
CO3	H	H	L	M	M	-	-	-	-	-	-	-
CO4	H	M	L	M	L	-	-	-	-	-	-	-

### Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	M
CO2	H	M
CO3	M	M
CO4	H	M

<b>H –High, M-Medium, L-Low</b>
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## V Semester

### Minor Project– II

<b>Course Code</b>	<b>:</b>	<b>16MCA55</b>		<b>CIE Marks</b>	<b>:</b>	<b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S</b>	<b>0:0:10:0</b>	<b>SEE Marks</b>	<b>:</b>	<b>100</b>
<b>Credits</b>	<b>:</b>	<b>05</b>		<b>SEE Duration</b>	<b>:</b>	<b>3 Hours</b>
<b>Course Learning Objectives (CLO):</b>						
Students are able to						
<ol style="list-style-type: none"> <li>1. Understand the method of applying computational knowledge to solve specific problems.</li> <li>2. Apply software engineering and management principles while executing the project.</li> <li>3. Demonstrate the skills for good presentation and technical report writing skills.</li> <li>4. Identify and solve complex computing problems using professionally prescribed standards.</li> </ol>						
<b>GUIDELINES</b>						
<ol style="list-style-type: none"> <li>1. Each project group will consist of maximum of two students</li> <li>2. The Student shall undertake minor project- II depending on the electives studied in the previous semesters / Research based / Industry Oriented</li> <li>3. Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey</li> <li>4. Allocation of the guides preferably in accordance with the expertise of the faculty</li> <li>5. The number of projects that a faculty can guide would be limited to six</li> <li>6. The minor project would be performed in-house</li> </ol>						
The implementation of the project must be preferably carried out using the resources available in the Department/college						
<b>Course Outcomes</b>						
After going through this course, the students will be able to						
<b>CO1:</b> Conceptualize, design and implement solutions for specific problems						
<b>CO2:</b> Apply project and resource managements skills considering the societal concerns						
<b>CO3:</b> Exhibit the solutions through presentations and technical reports						
<b>CO4:</b> Synthesize self-learning, Team Work and ethics						
<b>Scheme of Continuous Internal Examination (CIE)</b>						
Evaluation of the project work will be done by the committee appointed by the Director, Dept of MCA. The student should submit report on the mini project work.						
Evaluation will be carried out in THREE Phases.						
<b>Phase</b>	<b>Activity</b>					<b>Weightage</b>
<b>I</b>	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation					10%
<b>II</b>	Mid-term seminar to review the progress of the work and documentation					

	<ul style="list-style-type: none"> <li>Design and simulation / algorithm development / experimental setup</li> <li>Conducting experiments / implementation / testing</li> </ul>	25%
		25%
<b>III</b>	Oral presentation	10%
	Demonstration	20%
	Project report	10%

**Scheme for Semester End Examination (SEE)**

The evaluation will be done by Internal and External examiners. The following weightage would be given for the examination. Evaluation will be done in batches of 10 students.

1. Brief write-up about the project	05%
2. Presentation / Demonstration of the project	20%
3. Methodology and Experimental Results & Discussion	25%
4. Report	20%
5. Viva Voce	30%

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	M	-	-	M	-	H	M	L
CO2	-	-	-	-	M	M	-	H	M	H	-	-
CO3	M	M	H	-	M	-	-	-	M	-	M	-
CO4	-	M	-	-	-	H	M	-	M	-	H	-

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	M
CO2	L	L
CO3	-	M
CO4	M	M

**H-High, M-Medium, L-Low**

## VI Semester

## Major Project

<b>Course Code</b>	:	<b>16MCA61</b>		<b>CIE Marks</b>	:	<b>150</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>0:0:46:0</b>	<b>SEE Marks</b>	:	<b>150</b>
<b>Credits</b>	:	<b>23</b>		<b>SEE Duration</b>	:	<b>3 Hours</b>

**Course Learning Objectives:**

The students shall be able to

1. Understand the method of applying technical knowledge to solve specific problems.
2. Apply software engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills
4. Identify and solve complex application / research oriented problems using professionally prescribed standards

**GUIDELINES**

1. Major project will have to be done by only one student in his / her area of interest
2. Each student has to select a contemporary topic in the area of application or research that will use the technical knowledge and skill set
3. The project can be carried out on-campus or in an industry or an organization with prior approval from the Director, Department of MCA
4. The candidate must maintain and submit weekly project work diary duly signed by the internal and external guide to verify the regularity of the student
5. Internal Evaluation of the project work will be done by the evaluation committee appointed by the Director, Department of MCA.
6. The standard duration of the project is for 5 month duration, however if the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the committee.
7. Students are mandatorily required to publish in reputed journals/ conferences.

**Course Outcomes:**

After going through this course the students will be able to

**CO1:** Conceptualize, design and implement solutions for specific problem defined.

**CO2:** Communicate the solutions through presentations and dissertation report.

**CO3:** Apply project and resource management skills, professional ethics and societal concerns.

**CO4:** Exhibit self-learning, lifelong learning skills towards sustainable solutions.

**Scheme of Continuous Internal Examination (CIE)**

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide and members appointed by Director, MCA.

**CIE Phase wise Evaluation of Activities for Major Project**

<b>Phase</b>	<b>Activity</b>	<b>Marks</b>
I 5 <sup>th</sup> week	Synopsis submission, Preliminary seminar for the approval of selected topic and objectives formulation.	10
II 10 <sup>th</sup> week	Mid-term seminars to review the progress of the work and documentation – • SRS and algorithm development	40

	• Design and simulation/ experimental set up	40
III 15 <sup>th</sup> week	Conducting experiments / implementation / testing	20
	Demonstration	20
	Dissertation Report	20

In CIE, candidate must score 50% to take up SEE.

**Scheme for Semester End Evaluation (SEE):**

The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding SIX students.

**Evaluation will be done individually and marks distribution is as below**

- |  |   |    |
|--|---|----|
| a. Relevance of the project  | - | 25 |
| b. Project Standard with respect to the post-graduation / Research/application oriented- |   | 50 |
| c. Final Testing and Results with conclusion   | - | 25 |
| d. Viva-voce   | - | 50 |

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	P O1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	L	M	L	-	-	-	L	L
CO2	-	-	-	-		M	-	M	H	-	-	-
CO3	-	-	-	-	L	M	M		-	H	L	-
CO4	-	-	-	-	L	M	H	M	-	-	H	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	H
CO2	L	L
CO3	M	L
CO4	H	H

## VI Semester Seminar

<b>Course Code</b>	:	<b>16MCA62</b>		<b>CIE Marks</b>	:	<b>50</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S 0:0:4:0</b>		<b>SEE Marks</b>	:	<b>00</b>
<b>Credits</b>	:	<b>2</b>		<b>SEE Duration</b>		<b>--</b>
<b>Course Learning Objectives (CLO):</b>						
The students shall be able to:						
<ol style="list-style-type: none"> <li>1. Understand the technological developments in the chosen field of interest</li> <li>2. Explain the scope of work and challenges in the domain area</li> <li>3. Analyze technological developments of societal concerns, project management and sustainability</li> <li>4. Demonstrate presentation and report writing skills</li> </ol>						
<b>GUIDELINES</b>						
<ol style="list-style-type: none"> <li>1. The seminar presentation shall be done by individual students.</li> <li>2. The topic for seminar should be in one of the thrust areas relevant to industry or on-going research with in-depth technical review and analysis</li> <li>3. The topic can also be an extension of the Major project</li> <li>4. The student must be able to highlight or relate the technological developments with societal relevance and sustainability</li> <li>5. The students must mandatorily address professional computing practices relevant to the topic of study</li> <li>6. The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study</li> <li>7. Each student must submit both hard and soft copy of the presentation and report</li> </ol>						
<b>Course Outcomes:</b>						
After going through this course the student will be able to:						
<b>CO1:</b> Identify topics in recent trends in computing technology						
<b>CO2:</b> Perform literature / market / product survey and analyze information in the field of study						
<b>CO3:</b> Exhibit creative thinking abilities						
<b>CO4:</b> Demonstrate presentation and report writing skills						
<b>Scheme of Continuous Internal Evaluation (CIE):</b> Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of TWO senior faculty members. The evaluation criteria shall be as per the rubrics given below:						
<b>Rubrics for Evaluation:</b>						
<ul style="list-style-type: none"> <li>• Topic – Technical Relevance, Sustainability and Societal Concerns</li> <li>• Literature Review</li> <li>• Presentation Skills</li> <li>• Report</li> </ul>						15% 25% 35% 25%

<b>Mapping of Course Outcomes (CO) to Program Outcomes (PO)</b>												
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	-	M	M	M	M	H	H	-	-	L	M	-
<b>CO2</b>	L	M	-	-	-	-	-	-	-	H	-	-
<b>CO3</b>	-	L	M	-	H	L	L	-	-	-	M	-
<b>CO4</b>	-	-	-	-	-	L	L	M	H	-	-	-

<b>Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)</b>	
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	PSO1	PSO2
<b>CO1</b>	M	L
<b>CO2</b>	L	L
<b>CO3</b>	L	L
<b>CO4</b>	L	L