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

(I-IV) Semester MCA

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: **Use of Modern Tool:** 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 program 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

First Semester								
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
		Total		**19**	**1**	**3**	**2**	**25**
		Contact (Hrs/ week)		19	1	6	0	26
		Non-Contact(Hrs/week)*		0	1	0	8	09

Second Semester								
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
		Total		**19**	**1**	**3**	**2**	**25**
		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
		Total		**19**	**0**	**3**	**2**	**24**
		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**
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**
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
		Total		**18**	**1**	**7**	**2***	**28**
		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**
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**
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
		Total		**16**	**0**	**7**	**0**	**23**
		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
		Total		**0**	**0**	**25**	**0**	**25**

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
Total			**150**

I Semester

Data Structures (Theory & Practice)					
Course Code	**:**	**16MCA11**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10 Hrs**

Introduction to Data Structures

Data Structures and Arrays in C, Implementing Structures and Union, Pointers, Scope of Variables Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction

Unit – II **10 Hrs**

Arrays and Stacks

Dynamically Allocated Arrays, Sparse Matrices, Representation of Multidimensional Arrays, Stacks, Stacks using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks

Unit – III **09 Hrs**

Queues and Linked lists

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

Unit – IV **09 Hrs**

Trees

Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps, Binary Search Trees, Selection Trees, Forests, Counting Binary Trees

Unit – V **10 Hrs**

Graphs and Sorting

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

Unit – VI (Lab Component)

Part – A

Implement the following programs using C Language.

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", 2nd 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", 2nd 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

Operating Systems
(Theory & Practice)

Course Code	**:**	**16MCA12**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L: T: P: S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10 Hrs**

Introduction to Operating Systems

Operating system objectives and functions, evolution of operating systems, Unix – architecture, features, file system; Basic file attributes, filters – head, tail, cut, paste, tr, grep

Unit – II **10 Hrs**

Process Management

Process, Process States, Process Description, Process Control, CPU Scheduler and Scheduling Algorithms

Unit – III **10 Hrs**

Concurrency Control

Principles of Concurrency, Semaphore, Message Passing, Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Dining Philosopher's problem using semaphores

Unit – IV **10 Hrs**

Memory Management

Swapping, Contiguous Memory Allocation, Paging, Segmentation, Demand Paging, Page Replacement and Allocation of Frames

Unit – V **08 Hrs**

File and Disk Management

File Sharing, Protection, Directory Implementation, Allocation Methods, Free Space Management, Disk Structure, Disk Scheduling and Disk Management

Unit – VI (Lab Component)

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, 7th Edition, 2012, ISBN:978-93-325-1880-3
2	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts" , John Wiley, 8th Edition, 2010, ISBN :978-81-265-205-0
3	Sumitabha Das, "Unix Concepts and Applications", Mc Graw Hill, 4th Edition, 2012, ISBN:978-0-07-063546-3
4	P. Chakraborty, "Operating Systems", Jaico Publishing House, 1st 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)

Course Code	**:**	**16MCA13**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L: T: P: S 3:0:2:4**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **07 Hrs**

Introduction to Web Technologies

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.

Unit – II **07 Hrs**

Front End Design

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

Unit – III **08 Hrs**

Basics of JavaScript

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.

Unit – IV **08 Hrs**

JavaScript and HTML Documents

The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, Dom Tree Traversal and Modification.

Unit – V **08 Hrs**

Dynamic Documents with JavaScript

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:
   a) Parameter: A string
      Output: The position in the string of the left-most vowel
   b) 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, 1st Edition, 2012, ISBN: 9788131774199
3	Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", Pearson Education, 5th Edition, 2011, ISBN: 9780132151009
4	Chris Bates, "Web Programming Building Internet Applications", Wiley India, 3rd 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

Computer Organization and Architecture					
Course Code	**:**	**16MCA14**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**09 Hrs**

Number Systems and Boolean Algebra

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

Unit – II	**10 Hrs**

Combinational Logic and Sequential Logic

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

Unit – III	**09 Hrs**

Basic Structure of Computer and Machine Instructions

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

Unit – IV	**10 Hrs**

8086 Architecture

Introduction, Architecture of 8086 Microprocessor, Pin functions, Minimum / Maximum mode of operation

Unit – V	**10 Hrs**

8086 Programming

8086 instruction sets, addressing modes, Assembler directives, Programming examples

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 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, 5th Edition, 2002 ISBN-13 9781259005275.
3	Yu-Cheng Liu & Glenn A Gibson, "Microcomputer systems 8086/8088 family, Architecture, Programming and Design", Pearson Education Limited, 2nd Edition, 2003, ISBN-9788120304093.
4	Douglas V Hall, "Microprocessors and Interfacing", McGraw Hill, 2nd Edition, 2010, ISBN-13 9780070601673.

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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

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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

Discrete Mathematics					
Course Code	**:**	**16MAT15**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L-T-P-S: 4-2-0-0**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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.

Unit – I	**10 Hrs**

Set Theory and Counting

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.

Unit – II	**10 Hrs**

Logic

Propositional logic: Connectives, Truth table, Tautology, Contradiction, Logical equivalence, Logical implications, Laws of Logic, Rules of Inference, Quantifiers, Methods of Proof.

Unit – III	**09 Hrs**

Relations

Cartesian product and relations, Computer recognition: zero-one matrices and directed graphs Properties of relations, Equivalence relations, Posets and Hasse diagrams.

Unit – IV	**09 Hrs**

Functions

Functions: plain and one-to-one, onto functions, Stirling numbers of the second kind, Composition and inverse functions, Special functions.

Unit – V	**10 Hrs**

Graphs

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.

Course Outcomes

After going through this course the student shall be able to

CO1: Identify and interpret the fundamental concepts of discrete structures.

CO2: Apply the knowledge and skills obtained to examine and solve different types of Computational problems.

CO3: Analyze mathematical concepts like sets, reasoning, relational algebra and graph theory to solve the problems and optimize the solution.

CO4: Distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems arising in practical situations.

Reference Books

1	Ralph P Grimaldi, B.V.Ramana, "Discrete and Combinatorial Mathematics", An applied introduction, 5th Edition, Pearson Education, 2007, ISBN-10: 8177584243, ISBN-13:9788177584240
2	Kenneth H Rosen, "Discrete Mathematics & its Applications", 7th 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

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Mapping of Course Outcome to Program Outcome

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

Mapping of Course Outcome to Program Specific Outcome

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

H-High, M-Medium, L-Low

II Semester

Database Systems
(Theory & Practice)

Course Code	**:**	**16MCA21**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **08 Hrs**

Basic Concepts

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

Unit – II **08 Hrs**

Data Models and Basic SQL

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

Unit – III **09 Hrs**

Structured Query Language

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

Unit – IV **09 Hrs**

Database Design Theory and Normalization

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

Unit – V **10 Hrs**

Transaction Processing and Concurrency Control

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

Scheme of Continuous Internal Evaluation (CIE) for Theory

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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.

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Change of program is not permitted.

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CO4	H	H	M	L	L	-	M	M	M	-	L	L

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CO1	H	M
CO2	M	M
CO3	H	H
CO4	H	H

H-High, M-Medium, L-Low

II Semester

Object Oriented Programming
(Theory & Practice)

Course Code	**:**	**16MCA22**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L: T: P: S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

1. Develop an understanding of the essential principles in object oriented programming
2. Implement object oriented programming concepts using Python programming language
3. Incorporate design patterns standards for solving a real-world problem
4. Utilize object based approaches during software development

Unit – I **10 Hrs**

Foundations of Object Oriented Concepts

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.

Unit – II **10 Hrs**

Design Principles

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.

Unit – III **10 Hrs**

Design Patterns

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.

Unit – IV **09 Hrs**

Introduction to Python Programming Language

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).

Unit – V	09 Hrs

Object oriented programming using Python

Classes and Objects, functions, methods, Inheritance, polymorphism and Exception handling

Unit – VI (Lab Component)

Part – A

1. Write a python script to demonstrate searching technique (linear or binary)
2. Write a python script to demonstrate sorting (Bubble or Selection or Insertion or Quick)
3. Write a python program demonstrating polymorphism (operator and function)
4. Write a python program to demonstrate Inheritance and exception handling
5. Write a python program demonstrating 10 operations using python datatypes (any one)
   a) String b) List c) Tuple d) Sets and e) Dictionary

Part – B

Students will be given problem statements to implement any of the following design patterns using Use Case Diagram and Class Diagrams

1. **Facade** (Structural Pattern)
2. **Model View Control** (Structural Pattern)
3. **Command** (Behavior Pattern)
4. **State Pattern** (Behavior Pattern)
5. **Abstract Factory** (Creation Pattern)
6. **Singleton** (Creation Pattern)

Course Outcomes

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

CO1: Relate and recall object oriented and structured programming concepts

CO2: Demonstrate competency in object oriented concepts

CO3: Utilize object oriented concepts and develop solutions using python programming language

CO4: Examine UML design patterns and analyze design solutions using python programming language

Reference Books

1	Martin Fowler, "UML Distilled", Addison Wesley, 3rd Edition, 2003, ISBN: 0321193687, 978-0321193681
2	Chetan Giridhar, "Learning Python Design Patterns", Packet Publishing, 2nd Edition, 2016, ISBN: 978-1783283378
3	Allen Downey, Jeffrey Elker, Chris Meyers, "Learning with Python", Dreamtech press, 2013, ISBN 13: 978-9351198147

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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

Analysis and Design of Algorithms
(Theory & Practice)

Course Code	**:**	**16MCA23**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10 Hrs**

Introduction to Algorithms & Divide and Conquer technique

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

Unit – II **10 Hrs**

Decrease and Conquer & Greedy Method

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

Unit – III **10 Hrs**

Dynamic Programming & Coping with Limitations of Algorithmic Power

Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source , Shortest Paths: 0/1 Knapsack, The Traveling Salesperson problem

Unit – IV **08 Hrs**

Space and Time Trade Offs and Limitations of Algorithmic Power

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

Unit – V **10 Hrs**

Backtracking and Branch - Bound Technique

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

Unit – VI (Lab Component)

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 = {sl, s2,sn} 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), 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, 3rd Edition, 2016, ISBN-13: 9780321358288

2	Ellis Horowitz, Sanguthevar Rajasekaran, Sartaj Sahni, "Fundamentals of Computer Algorithms", Galgotia, 2nd 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

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 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

Software Engineering					
Course Code	**:**	**16MCA24**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S 3:2:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**08 Hrs**

Introduction & Software Process Models

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

Unit – II	**07 Hrs**

System Modeling, Architectural Design and implementation

System Modeling: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering; Architectural Design: Architectural design decisions, Architectural views, Architectural patterns

Unit – III	**07Hrs**

Software Testing & Evolution

Software Testing: Development testing, Test driven development, Release testing, User testing; Software Evolution: Evolution processes, Legacy systems, Software maintenance

Unit – IV	**07 Hrs**

Advanced Software Engineering

Component-based Software Engineering: Components and component models, CBSE processes, Component composition; Distributed Software Engineering: Distributed systems, Client–server computing, Software as a service

Unit – V	**07 Hrs**

Software Management

Project management: Risk management, managing people, Teamwork; Project planning: Plan driven development, Project scheduling, Estimation techniques

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 an expert panel in two phases appointed by the Director, MCA,

Tutorial Component

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

Expected Course Outcomes

After going through this course the student will be able to

CO1: Interpret the basic concepts of Software Engineering, professional ethics and Demonstrate the phases of software development Life cycle using various system models.

CO2: Compare various testing techniques and relate Software advancement methods to build Quality Software products.

CO3: Analyze and Apply emerging software engineering concepts and methods for construction of Software systems.

CO4: Evaluate project management strategies for effective software development.

Reference Books

1	Ian Sommerville, "Software Engineering", Pearson Education Ltd, 10th Edition, 2015, ISBN: 9780133943030
2	Roger S Pressman, "Software Engineering- A Practitioner's Approach", McGraw-Hill, 8th Edition, 2015, ISBN: 978-0078022128
3	Pankaj Jalote, "Software Engineering", Wiley India Pvt, Ltd, 3rd Edition, 2011, ISBN: 9788126523115
4	Bernd Bruegge & Allen H, Dutoit, "Object-oriented Software Engineering: Using UML, Patterns and Java", Pearson Education Ltd, 3rd Edition, 2010, ISBN: 9780136066811

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 Outcome to Program Outcome

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

Mapping of Course Outcome to Program Specific Outcome

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

H-High, M-Medium, L-Low

II Semester

Management Information Systems & E-Commerce					
Course Code	**:**	**16MCA25**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**10 Hrs**

Introduction to Information Systems in Business

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)

Unit – II	**10 Hrs**

Computer Hardware and Software

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)

Unit – III	**10 Hrs**

Information Systems for Business, eCommerce and Enterprise Collaboration

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)

Unit – IV	**09 Hrs**

Information Systems for Decision Support, Strategic Advantages

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)

Unit – V	**09 Hrs**

Management Security Challenges & Controls

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)

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, Self-study is reviewed and evaluated in two phases by an expert panel, appointed by Director, MCA,

Course Outcomes

After going through this course the student will be able to

CO1: Illustrate the fundamentals of a computer based information systems and enterprises

CO2: Distinguish the preliminaries of technologies and Experiment with business information systems and Decision support systems

CO3: Apply E-Commerce initiatives in various Business applications

CO4: Perceive the significance of Managerial strategies and challenges in IT sector

Reference Books

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, 4th 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

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 Outcome to Program Outcome

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

Mapping of Course Outcome to Program Specific Outcome

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

H-High, M-Medium, L-Low

III Semester

Computer Networks
(Theory and Practice)

Course Code	**:**	**16MCA31**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

1. Understand the fundamental concepts of computer networks
2. Familiarize with the design issues and protocols of various layers
3. Recognize the application of different algorithms to solve design issues
4. Analyze various layering protocols in computer networks

Unit – I	**10 Hrs**

Introduction- Introduction, Uses of Computer Networks, Network Hardware, Network Software, Reference Models, Example Networks

Physical Layer-Guided Transmission Media, Digital Modulation and Multiplexing

Unit – II	**10 Hrs**

Data Link Layer-Data link Layer Design issues, Error Detection and Correction, Sliding Window Protocols

Medium Access Control-The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Broadband Wireless, Bluetooth, Data Link Layer Switching

Unit – III	**10 Hrs**

The Network Layer- 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

Unit – IV	**10 Hrs**

The Transport Layer-The Transport Service, Elements of Transport Protocols, Congestion Control, Internet transport protocols- TCP, UDP, Performance issues

Unit – V	**08 Hrs**

The Application Layer-The Domain Name System, Electronic Mail, The World-Wide-Web, Streaming Audio and Video

Unit – VI (Lab Component)

Part – A

1. Create a LAN with five nodes implementing star topology in it. Demonstrate class full Addressing in it.
2. Create a bridge and demonstrate tunneling using open VPN.
3. Demonstrate routing with NAT and iptables.
4. Compare file transfer with wired and wireless networks.
5. Build a DNS and DHCP server using dns-masq.

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, 5th 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

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	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

Software Testing and Practices
(Theory and Practice)

Course Code	**:**	**16MCA32**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**09 Hrs**

Basics of software testing - 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

Unit – II	**10 Hrs**

Boundary value testing, Equivalence class testing, Decision table based testing-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

Unit – III	**10Hrs**

Path Testing, Data flow testing, Life Cycle–Based Testing-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

Unit – IV	**09 Hrs**

Integration Testing, System testing-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

Unit – V	**10 Hrs**

Test Management and Automation-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

Introduction to Selenium- Overview and working with Selenium IDE, Selenium Web Driver

Unit – VI (Lab Component)

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>=1800), commission=20%
   ii) if (sales is between 1000 and 1800), commission=15%
   iii) and if (sales<=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, 4th Edition, First Indian Reprint, 2014, ISBN-13:9781466560680
2	Srinivasan Desikan Gopalaswamy, "Software Testing Principles and Practices", Pearson Education, 5th Edition, 2008 , ISBN: 9788177581218

3	Unmesh Gunecha, "Learning Selenium Testing Tools with Python", PACKT Publishing, 2014,ISBN: ISBN 9781783983506

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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
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CO2	M	H	L	H	L	-	M	H	M	H	M	L
CO3	M	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

III Semester

Elective – I
Content Management System
(Theory and Practice)

Course Code	**:**	**16MCA331**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**08 Hrs**

What Content Management is (and isn't)?, Points of Comparison, Acquiring a CMS, The Content Management Team, CMS Feature Analysis, Content Modeling, Content Aggregation

Unit – II	**10 Hrs**

First Post-What Is WordPress?, Popularity of WordPress, Content and Conversation, Getting Started, Finishing Up

Code Overview-downloading, directory and file structure, wordpress configuration, wp-content user playground

Working With Wordpress Locally-Benefits of Working Locally, Tools for Component Administration, Configuration Details, Deploying Local Changes

Tour of Core- What is in the Core?, Using the core as a Reference

Unit – III	**10 Hrs**

The Loop- Understanding the Loop, Template Tags, Customizing the loop, Global variables

Data Management- Database Schema, Table Details, Word Press Database Class, Direct Database Manipulation

Custom Post Types, Custom Taxonomies and Meta data-Understanding Data in Word Press, Word Press Taxonomy, Building your own taxonomy, Meta data

Theme Development-Why use a Theme? Installing a Theme, What is a Theme?

Unit – IV	**10 Hrs**

Introduction to Drupal-Content Management Systems, Creating Content

Creating and Managing Content-Understanding the Basics, Creating Content in Drupal, Editing Content, Other Content Options, Deleting Content, Finding Content

Creating and Managing Users- Users, Roles, and Permissions, User Accounts, Configuring User Account Settings, Creating Roles, Assigning Permissions, Creating User Accounts, User Generated Accounts

Taxonomy-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., 1st Edition, 2016, ISBN 978-1-4919-0812-9
2	Todd Tomlinson," Beginning Drupal 7",1st Edition, Apress Publishing Company, ISBN-13 (pbk): 978-1-4302-2859-2
3	Brad Williams, David Damstra, Hai Stern," Professional WordPress: Design and Development", 3rd 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.

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	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)

Course Code	**:**	**16MCA332**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10 Hrs**

Introduction - 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

Unit – II **10 Hrs**

Magic Methods - Magic method syntax, Available Methods

Metaclasses-Classes and Objects, Writing Metaclasses, When to use Metaclasses

Class Factories- Understanding a Class Factory Function, Determining when you should write class factories

Abstract Base classes- Declaring a Virtual Subclasses, Declaring a Protocol, Built-in Abstract Base Classes

Reading and Writing Files- What Kinds of Files are there?, Opening a File, Techniques for Reading Files, Writing Files, Notes to File Away

Unit – III **8 Hrs**

GUI Programming: Tkinter - 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

Unit – IV **10Hrs**

Database Programming - 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

Unit – V **10 Hrs**

Web Development- 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

Unit – VI (Lab Component)

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”, 3rd Edition, Pearson, 2016 ISBN:978-93-325-5536-5
3	Paul Gries, Jennifer Campbell, Jason Montojo, Edited by Lynn Beighley, “Practical Programming”,2nd Edition Reprint, The Pragmatic BookShelf, 2014, ISBN: 9781937785451, 1937785459

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	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

Elective – I
Model View Controller Programming
(Theory and Practice)

Course Code	**:**	**16MCA333**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

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

Unit – I **09 Hrs**

Introduction to MEAN (MongoDB, ExpressJS, AngularJS, NodeJS)

Three-tier web application development, Introduction to JavaScript and MEAN,Introduction to Node.js, JavaScript event-driven programming

Node.js - event-driven programming, JavaScript closures Node modules, Common JS modules, Node.js core modules, Node.js third-party modules,Node.js file modules

Introduction to AngularJS-Key concepts of AngularJS, the core module of AngularJS, The angular global object, AngularJS modules Two-way data binding

Unit – II **10 Hrs**

Building Express Web Application - Introduction to Express, Installing Express, Creating your first Express application, **The application, request and response objects**- The application object, The request object, The response object, External middleware,

Implementing the MVC pattern-Application folder structure, Horizontal folder structure, Vertical folder structure, File-naming, conventions, Implementing the horizontal folder structure,

Configuring an Express application-Environment configuration files Rendering views, Configuring the view system

Rendering EJS views-Configuring the view system 71, Rendering EJS views

Unit – III **10 Hrs**

Creating a MEAN CRUD Module

Implementing the AngularJS MVC module-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

Implementing the AngularJS module views- The create-article view, The view-article view, The edit-article view, The list-articles view

Unit – IV **09 Hrs**

Introduction to MongoDB - Introduction to NoSQL, Introducing MongoDB, MongoDB sharding, **MongoDB CRUD operations**-Creating a new document, Creating a document using insert(), Creating a document using update(), Creating a document using save()

Unit – V **10 Hrs**

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 Mongodb
2. Write a viewfor 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 mongodb 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

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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
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	M	M
CO2	M	M
CO3	H	H
CO4	H	H

H-High, M-Medium, L-Low

III Semester

Elective – II
System Programming

Course Code	**:**	**16MCA341**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**09 Hrs**

Introduction to System Software- 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.

Unit – II	**10 Hrs**

Assemblers-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

Unit – III	**09 Hrs**

Macro processors-Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, design of Macro Preprocessor

Unit – IV	**10 Hrs**

Linkers and Loaders- 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

Unit – V	**10 Hrs**

Essential concepts of Systems programming for Linux as Open Source OS-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

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 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, 2nd Edition, 2013 ISBN 978-1-449-33953-1
3	Leland L. Beck, "System Software – An Introduction to Systems Programming", Pearson Education Asia, 3rd 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
CO1	L	L	-	M	L	-	M	-	L	-	M	L
CO2	L	L	-	L	L	-	L	-	L	-	M	L
CO3	L	M	L	L	L	-	L	-	L	-	L	L
CO4	L	L	L	M	L	-	M	-	L	-	M	L

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

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

H-High, M-Medium, L-Low

III Semester

Elective – II
Advanced Database Systems

Course Code	:	**16MCA342**	**CIE Marks**	**:**	**100**
Hrs/Week	:	**L:T:P:S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	:	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10 Hrs**

Introduction and Exploring NOSQL- NOSQL – Definition and Introduction, Sorted ordered Column – Oriented stores, Key/Value stores, Document databases, Graph Databases

Interfacing and Interacting with NOSQL – If No SQL, then what?, Language Binding for NoSQL data stores

Unit – II **10 Hrs**

Understanding the storage architecture – Working with column- oriented databases, Document store internals, Understanding Key/Value stores

Performing CRUD Operations – Creating Records, Accessing Data, Updating and Deleting Data

Querying NOSQL stores – Similarities between SQL and MongoDB query features, Accessing data from Column-Oriented Database

Unit – III **10 Hrs**

Modifying Data stores and Managing Evolution – changing document databases, schema evolution in column oriented database

Indexing and Ordering Datasets - Essential concepts behind a database index, indexing and ordering in MongoDB, creating and using indexes in MongoDB

Managing Transactions - RDBMS and ACID , Distributed ACID, Upholding CAP, Consistency implementation

Unit – IV **10 Hrs**

Gaining proficiency with NOSQL

Using NOSQL in the CLOUD, Scalable Parallel Processing with Map Reduce, Analyzing Big Data with HIVE, Surveying Database Internals – MongoDB internals

Unit – V **08 Hrs**

Developing and Administration-PHP and MongoDB, Python and MongoDB, Creating Blog application with PHP Driver, Database Administration

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

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

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

H –High, M-Medium, L-Low

III Semester

Elective – II
Operations Research

Course Code	**:**	**16MCA343**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

1. Understand the importance and applications of operations research in different domains
2. Formulate the real world problems using mathematical models
3. Identify different techniques to obtain optimal solution using OR models
4. Explore and optimize Linear Programming Problem, Transportation problem, Assignment problems, network models, game theory and metaheuristics
5. Explore practices to obtain good feasible solution using heuristic approach

Unit – I	**10 Hrs**

Introduction to Operations Research & LPP-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

Unit – II	**10Hrs**

Transportation and Assignment Problems- 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.

Unit – III	**10 Hrs**

Network Models- Scope and Definition of Network Models, CPM and PERT – Network representation, CPM computations, Construction of the Time schedule, PERT Networks

Unit – IV	**10 Hrs**

Duality and Game Theory -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

Unit – V	**8 Hrs**

Non-Linear Programming –Metaheuristics

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, 9th Edition, 2014, ISBN: 978-93-325-1822-3, First Impression
2	Frederick S. Hillier & Gerald J. Lieberman, "Introduction to Operations Research", Tata McGraw Hill, 8th 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
CO1	H	M	L	-	-	-	-	L	L	M	M	M
CO2	M	M	-	-	M	-	-	-	M	-	-	-
CO3	M	M	M	M	L	-	M	M	L	M	M	M
CO4	L	H	L	H	-	-	L	M	M	M	L	-

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

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

H –High, M-Medium, L-Low

III Semester

Research Methodology					
Course Code	**:**	**16MCA35**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 3:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**7 Hrs**

Introduction - Meaning of research, Types of research, Research and scientific method

Defining the research problem- Selecting the problem, necessity of defining the problem, techniques involved in defining the problem

Research Design – Meaning of research design, Need and features of a good Design, Different research designs

Unit – II	**7 Hrs**

Methods of Data Collection-Experiment and Surveys, Collection of Primary data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection

Unit – III	**07 Hrs**

Design of Sample Surveys-Sample Design, Sampling and Non sampling Errors, Sample survey v/s Census Survey, Types of Sampling Designs, Simple numerical problems

Unit – IV	**08 Hrs**

Data Preparation - Data Preparation Process, Problems in Preparation Process, Missing Values and Outliers, Types of Analysis, Statistics in Research,

Descriptive Statistics - Measures of Central Tendency, Measures of Dispersion, Hypothesis – Basic concepts of hypothesis, Testing of Hypothesis

Unit – V	**7 Hrs**

Essential Report Writing- 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

Reference Books

1. Kothari CR, "Research Methodology Methods and Techniques " , New Age International, 2014, 3rd 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 ", 7th Edition, Pearson Education, New Delhi, ISBN : 9788177585841

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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.

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

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

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

	PSO1	PSO2
CO1	M	M
CO2	H	L
CO3	L	M
CO4	H	M
H-High, M-Medium, L-Low		

IV Semester

Enterprise Application Programming
(Theory and Practice)

Course Code	**:**	**16MCA41**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

1. To understand and use different enterprise design pattern techniques
2. Apply the knowledge of frameworks and Enterprise Application Development Tools
3. Design a Java program efficiently using Inheritance, Interfaces and Packages
4. Develop Enterprise Application solutions using Design Patterns

Unit – I **09 Hrs**

Introduction- 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

Introduction to Java Programming- The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, Java Keywords

Unit – II **09Hrs**

Classes and Methods-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

Unit – III **12 Hrs**

Servlets- 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

Introduction to EJB- The Enterprise JavaBeans Tier-Business Logic, Enterprise Beans as J2EE Business Objects Enterprise Beans and EJB Containers, Session Beans

Unit – IV **08 Hrs**

Implementing JSP tag extensions- 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

Unit – V	10 Hrs
Persistence Management and Design Patterns- 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	

Unit – VI (Lab Component)

Part – A

1. Write a Java program to
   a. Create a package named shape
   b. Create classes in the package representing common shapes like Square, Triangle, and Circle
   c. Import and compile these classes in other program
2. Write a Java Servlet Program to implement a dynamic HTML for following scenarios
   a. User name and password should be accepted in HTML
   b. Verify the username and password using a ServletConfig initparam and display the appropriate message on another Servlet
3. Write a Java Servlet Program to implement sessions (Using HTTP Session Interface)
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
5. Write a Java Servlet Program to count the number of hits to a website using Filters
6. Write a Java Servlet Program to enter the login credentials and verify the same using hibernate frame work

Part – B

6. Write a JAVA Servlet Program to implement and demonstrate get() and post() methods (Using HTTP Servlet Class)
7. Write a JAVA Servlet Program using cookies to remember user preferences.
8. Write a Java Servlet program to display all the methods which are present in ServletConfig and ServletContext
9. Write an EJB application to demonstrate Session Beans (with business logic)

Course Outcomes

After going through this course the student will be able to

CO1: Understand the challenges of enterprise applications

CO2: Apply JAVA support and API skills for Enterprise Application Development

CO3: Analyze the enterprise requirement to implement real world application

CO4: Manage deployment configurations according to the enterprise application need

Reference Books

1.	Inderjeet Singh, Beth Stearns, Mark Johnson and the Enterprise Team "Designing Enterprise Applications" with the Java TM 2 Platform, Enterprise Edition, 2nd 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. 2nd 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.

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	-	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

IV Semester

Elective – III

Advanced Computer Networks

(Theory and Practice)

Course Code	**:**	**16MCA421**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I **10Hrs**

Concepts of Storage Network- 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.

Unit – II **10 Hrs**

Internet Protocol- 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

Unit – III **10 Hrs**

Mobile IP - 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

Private Network Interconnection- 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

Unit – IV **10 Hrs**

Wireless Communication- 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

Unit – V **08 Hrs**

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, 4th Edition, Pearson Education, 2001, ISBN 81-7808-444-9

Scheme of Continuous Internal Evaluation (CIE) for Theory

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Scheme of Semester End Examination (SEE) for Theory

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Scheme of Semester End Examination (SEE) for Practical

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

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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)

Course Code	**:**	**16MCA422**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**10 Hrs**

Introduction to Mobile Application Development Ecosystems- History of Mobile Application Development, Understanding Ecosystems, Hybrid Application Frameworks, Challenges by Mobile Application Layers, System Software, Mobile Application Testing

Unit – II	**10 Hrs**

Getting Started with Android Programming & Android User Interface-What is Android? Obtaining the required tools, Creating your First Android Application, Anatomy of an Android Application, View Groups, Basic views, Fragments

Unit – III	**10 Hrs**

SMS Messaging and Networking-Sending SMS Messages programmatically, Getting Feedback after Sending the Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warning,Sending E-Mail

Networking- Downloading Binary Data, Downloading Text Files, Accessing Web Services Using the GET Method, Performance Asynchronous Calls

Unit – IV	**10 Hrs**

Creating Location Based Services Applications- 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

Unit – V	**08 Hrs**

Publishing Android Applications-Versioning, Digitally Signing your Android Applications

Deploying APK Files- Using the adb.exe Tool, Using a Web Server, Publishing on the Android Market

Unit – VI (Lab Component)

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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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 Evaluation (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.

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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)

Course Code	**:**	**16MCA423**	**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:2:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**10 Hrs**

Introduction-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

Unit – II	**10Hrs**

Two Dimensional Geometric Transformations-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

Unit – III	**10Hrs**

Two Dimensional Viewing-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

Unit – IV	**09Hrs**

Three Dimensional Geometric Transformations, Viewing and Curves-Three Dimensional Translation, Rotation, Scaling, The three dimensional viewing concepts, Three dimensional viewing pipeline, Orthogonal Projection, Oblique Parallel Projection, Perspective Projection, Bezier spline curves

Unit – V	**09Hrs**

Computer Animation, Illumination Models- Raster methods for computer animation, Design of animation sequences, Traditional animation techniques, General computer animation functions, OpenGL illumination and Surface rendering functions

Unit –VI (Lab Component)

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, 4th 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, 6th Edition, 2012, ISBN-13: 978-0-13-254523-5

Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of Two Tests, Two Quizzes and Two assignments. The test will be evaluated 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.

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	-	M	L	M	-	L	-	L	-	-	-
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

Course Code	**:**	**16MCA431**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L :T :P: S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Pre-requisite: Student must know the concepts of computer networks (16MCA31)

Unit – I	**08 Hrs**

Introduction-Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, , A Model for Network Security

Symmetric Encryption and message confidentiality-Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4

Unit – II	**10 Hrs**

Public-Key Cryptography and Message Authentication- 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

Key Distribution and User Authentication- Kerberos (Version 4 & 5), X.509 Certificates, Public Key Infrastructure

Unit – III	**10 Hrs**

Network Access Control and Cloud Security- 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

Unit – IV	**10 Hrs**

Transport-Level Security- Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS Secure Shell (SSH)

Wireless Network Security-Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security

Electronic Mail Security-Pretty Good Privacy (PGP), S/MIME, Domain Keys Identified Mail (DKIM**)**

IP Security-IP Security Overview, IP Security Policy, Encapsulating Security Payload,

Combining Security Associations, Internet Key Exchange

Unit – V	10 Hrs

Malicious Software-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.
Intruders -Intruders, Intrusion Detection, Password Management
Firewalls-The Need for Firewalls, Firewall characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations

Self-Study Component -
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
Topics
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)

Course Outcomes
After going through this course the students will be able to
CO1: Define and illustrate network security concepts and principles
CO2: Analyze the working of security principles to system design
CO3: Apply appropriate techniques to solve network security threats
CO4: Evaluate system security using network security controls

Reference Books

1.	William Stallings "Network Security Essentials Applications and Standards", 5th Edition, 2014 , Pearson, ISBN-13 9780133370522.
2.	William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition, 2014, Pearson, ISBN-13 9780133354690.
3.	Charles P Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in computing", 5th 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
CO1	H	H	M	H	H	L	M	M	M	-	L	M
CO2	H	H	M	M	H	-	M	M	M	-	-	L
CO3	H	H	M	M	H	L	L	L	L	-	L	-
CO4	H	H	M	H	H	-	M	M	M	-	L	L

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

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

H-High, M-Medium, L-Low

IV Semester

Elective – IV
Information Retrieval

Course Code	**:**	**16MCA432**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:4**		**SEE Marks**	**:**	**100**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**10 Hrs**

Introduction to information retrieval and architecture of a search engine-Search Engines and Information Retrieval- What Is Information Retrieval? The Big Issues, Search Engines, Search Engineers

Architecture of a Search Engine- What is an Architecture? Basic Building Blocks, Breaking It Down

Unit – II	**10 Hrs**

Crawls and Feeds- Deciding what to search, Crawling the Web, Crawling Documents and Email, Document Feeds, The Conversion Problem, Storing the Documents, Detecting Duplicates

Processing Text - From Words to Terms, Text Statistics, Document Parsing, Document Structure and Markup, Link Analysis, Information Extraction, Internationalization

Unit – III	**10 Hrs**

Ranking with Indexes - Overview, Abstract Model of Ranking, Inverted indexes, Compression, Auxiliary Structures, Index Construction, Query Processing

Unit – IV	**08Hrs**

Queries and Interfaces- Information Needs and Queries, Query Transformation and Refinement, Showing the Results, Cross-Language Search

Unit – V	**10 Hrs**

Retrieval Models - Overview of Retrieval Models , Probabilistic Models, Ranking Based on Language Models, Complex Queries and Combining Evidence, Web Search, Machine Learning and Information Retrieval

Evaluating Search Engines- Why Evaluate?, The Evaluation Corpus, Effectiveness Metrics, Efficiency Metrics

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 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 and Search Engine

CO2: Deploy efficient techniques for indexing of document objects that are retrieved

CO3: Apply IR principles to retrieve relevant information

CO4: Analyze and understand different 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, 3rd Edition, 2009. ISBN13: 9780134638379
4.	Robert. R. Korfhage, "Information Storage & Retrieval", John Wiley & Sons, Inc. New York, NY, USA, 4th 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

Course Code	**:**	**16MCA433**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

Graduates shall be able to

1. Understand the basics of simulation and various simulation models
2. Distinguish different types of random number and variate generation techniques for solving problems through statistical functions
3. Explore verification, validation and optimization on simulation models
4. Estimate the performance of system simulation models

Unit – I **10 Hrs**

Introduction -Discrete and continuous systems, Model of a system, Types of Models, Discrete-Event System Simulation, Steps in a Simulation Study

Statistical Models in Simulation -Discrete Random Variables, Continuous Random Variables, Cumulative distribution function, Useful statistical models, Discrete distributions, Continuous distributions- Uniform distribution, Exponential distribution, Normal distribution, Empirical distributions

Unit – II **10 Hrs**

Random-Number Generation - Properties of random numbers, Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for random numbers

Random-Variate Generation - Inverse transform technique, Acceptance-Rejection technique

Unit – III **10 Hrs**

Simulation Examples - Waiting Line Models, Simulating a Single-Server Queue, Simulating a Queue with Two Servers, News Dealer's Problem

General Principles - Concepts in Discrete-Event Simulation, The Event-Scheduling / Time-Advance Algorithm, Manual simulation using Event Scheduling

Unit – IV **09 Hrs**

Input Modeling - Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting Input models without data, Multivariate and Time-Series input models

Verification and Validation - Model building, verification and validation, Verification of simulation models, Calibration and validation of models

Unit – V **09 Hrs**

Estimation of Absolute Performance

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

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 an expert panel in two phases appointed by the Director, MCA

Course Outcomes

After going through this course the student will be able to

CO1: Understand the fundamentals of Simulation and various simulation models using real world examples

CO2: Design a simulation model for solving a real world Problem

CO3:Apply different techniques for simulation models

CO4: Evaluate and analyze the results of the Simulation models

Reference Books

1	Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, "Discrete-Event System Simulation", Pearson Education, 5th Edition, 2013, ISBN: 978-81-317-9699-3 first impression
2	Geoffrey Gordon, "System Simulation", Pearson Education, 2015, ISBN: 9789332550247

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 Evaluation (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, 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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	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	-

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

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

H-High, M-Medium, L-Low

IV Semester

Software Project Management

Course Code	**:**	**16MCA44**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 3:2:0:4**	**SEE Marks**	**:**	**100**
Credits	**:**	**5**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**08 Hrs**

Introduction to Software Project Management- 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

Unit – II	**08 Hrs**

Project Evaluation and Programme Management- 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.

Unit – III	**08 Hrs**

An Overview of Project Planning-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

Unit – IV	**06 Hrs**

Activity Planning-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

Risk Management – Risk, Categories of Risk, Risk Identification, Risk Assessment, Risk Planning and Risk Management

Monitoring and Control- 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)

Unit – V **06 Hrs**

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 activites, 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, 5th 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., 11th 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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	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

Business Communication					
Course Code	**:**	**16MCA45**	**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**3**	**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO)

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

Unit – I	**08 Hrs**

Basics of Communication, Communication: An Overview – 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

Process of Communication- Objectives of Communication, Basic elements of Communication process, Process of Communication, Models of Communication Process

Effective Communication-Essentials of Effective Communication, 7Cs of Effective Communication, 4Ss of Effective Communication, IMPRESS Model

Barriers to Communication–What is Miscommunication? Barriers of Communication, Categorization of Barriers to Communication, Methods of Overcoming Communication Barriers

Unit – II	**08 Hrs**

Oral and Non-Verbal Communication- Oral Presentation Skills – 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

Listening Skills – 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

Interview – 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

Non-Verbal Communication – Common Indicators of Non-Verbal Communication, Features of Non-Verbal Communication, Types of Non-Verbal Communication (Proxemics, Kinesics, Paralanguage, Oculesics, Artifactics, Tactilics / Haptics)

Unit – III	**07 Hrs**

Written Communication – Part I

Business Letters – Meaning of Business Letter, Essentials of a good Business Letter, Basic Considerations, Styles of a Letter Layout, Parts of a Business Letter,

Types of Business Letters –Types of Business Letters, Differences between a memorandum and a Letter

E-Mail Writing –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

Paragraph Writing – What is a Paragraph?, Classification of a Paragraph, Building Paragraphs, 5-Step Process to Paragraph Development, Prewriting Paragraphs, Coherence and Unity in Paragraph Writing

Unit – IV	**07 Hrs**

Written Communication – Part II

Job Application and Resume Writing – 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

Report Writing – 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

Unit – V	**06 Hrs**

Applications

Assertiveness – Positive/Negative Thinking, Assertive Rights, Strategies for Assertive Behavior, Indicators of Assertive Behaviour, Success in Relationships, How to say No?, Mental Locks

Body Sport – Positive Gestures, Handshakes, The Gazes, Smiles, Hand Movements, Different Styles of Walking, Voice Modulations

Group Discussions and Interviews–Group Discussions, Strategies for Group Discussions, Interviews, Facing the Interview Board, Body Sport for Interviews, Negotiations

Course Outcomes

After going through this course the students will be able to

CO1: Understand the need and significance of Communication

CO2: Comprehend the different types of communication in Organizations

CO3: Deliver Presentations effectively with positive group communication exchanges

CO4: Demonstrate Interpersonal skills proficiently and apply the concepts in Business Environment

Reference Books

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, 2nd Edition, 2010, ISBN: 978-81-203-3848-7
3.	P D Chaturvedi and Mukesh Chaturvedi, "Business Communication: Concepts, Cases and Applications", Pearson Education, 2nd Edition, 2007. ISBN: 978-81-317-0172-7

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

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

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

H-High, M-Medium, L-Low

IV Semester

MINOR PROJECT – I						
Course Code	**:**	**16MCA46**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:10:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives (CLO):

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

GUIDELINES

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

Course Outcomes

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems
CO2: Communicate the solutions through presentations and technical reports
CO3: Apply resource managements skills for projects
CO4: Synthesize self-learning, team work and ethics

Scheme of Continuous Internal Examination (CIE)

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.

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation	10%
II	Mid-term seminar to review the progress of the work and documentation • Design and Simulation / Algorithm development / Experimental Setup • Conducting experiments / Implementation / Testing	 25% 25%
III	Oral presentation Demonstration Project report	10% 20% 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	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