RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
RV Vidyaniketan Post, Mysuru Road
Bengaluru – 560059

Scheme and Syllabus of I & IV Semester

(Autonomous System of 2018 Scheme)

DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work and Innovation

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DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

VISION

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

MISSION

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

PROGRAMME OUTCOMES (PO)

MCA graduates will be able to:

PO1 **Computational Knowledge:** Acquire in-depth computational knowledge and mathematics with an ability to abstract and conceptualize 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 analyze and extract information relevant to unfamiliar problems and synthesize 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

ABBREVIATIONS

Sl. No.	Abbreviation	Acronym
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	CE	Professional Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	TE	Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PY	Physics
21.	CY	Chemistry
22.	MA	Mathematics
23.	MCA	Master of Computer Applications
24.	MST	Structural Engineering
25.	MHT	Highway Technology
26.	MPD	Product Design & Manufacturing
27.	MCM	Computer Integrated & Manufacturing
28.	MMD	Machine Design
29.	MPE	Power Electronics
30.	MVE	VlSI Design & Embedded Systems
31.	MCS	Communication Systems
32.	MBS	Bio Medical Processing Signal & Instrumentation
33.	MCH	Chemical Engineering
34.	MCE	Computer Science & Engineering
35.	MCN	Computer Network Engineering
36.	MDC	Digital Communication
37.	MRM	Radio Frequency and Microwave Engineering
38.	MSE	Software Engineering
39.	MIT	Information Technology
40.	MBT	Biotechnology
41.	MBI	Bioinformatics

CONTENTS

RV COLLEGE OF ENGINEERING®, BENGALURU - 560059

(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

FIRST SEMESTER CREDIT SCHEME

Sl.No	Course Code	Course Title	BoS	Credit Allocation			Total credits
				Lecture	Tutorial	Practice	
1	18MAT11	Discrete Mathematics	MAT	3	1	0	4
2	18MCA12	Computer Organization and Architecture	MCA	3	0	0	3
3	18MCA13	Data Structures using C	MCA	3	1	1	5
4	18MCA14	Object Oriented Programming	MCA	3	1	1	5
5	18MCA15	Web Programming	MCA	3	1	1	5
Total number of Credits				**15**	**4**	**3**	**22**
Total Number of Hours/Week+ Counselling				**15**	**8**	**6**	**30**

SECOND SEMESTER CREDIT SCHEME

Sl.No	Course Code	Course Title	BoS	Credit Allocation			Total credits
				Lecture	Tutorial	Practice	
1	18MCA21	Software Engineering	MCA	3	0	0	3
2	18MCA22	E-Commerce	MCA	3	1	0	4
3	18MCA23	Data Base Systems	MCA	3	1	1	5
4	18MCA24	Operating Systems	MCA	3	1	1	5
5	18MCA25	Java Programming	MCA	3	1	1	5
Total number of Credits				**15**	**4**	**3**	**22**
Total Number of Hours/Week+ Counselling				**15**	**8**	**6**	**30**

THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Credits**
1	18MCA31	Research Methodology	MCA	3	0	0	**3**
2	18MCA32	Analysis and Design of Algorithms	MCA	3	1	1	**5**
3	18MCA33	Computer Networks	MCA	3	1	1	**5**
4	18MCA34X	Elective I	MCA	3	1	0	**4**
5	18MCA35X	Elective – II (With Practice)	MCA	4	0	1	**5**
Total number of Credits				**16**	**3**	**3**	**22**
Total Number of Hours/Week (Counseling+ Placement Activity)				**16**	**6**	**6**	**30 (28+2)**

FOURTH SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Credits**
1	18MCA41	Software Testing	MCA	3	0	1	**4**
2	18MCA42	Modern Application Development	MCA	3	0	1	**4**
3	18MCA43X	Elective III	MCA	3	0	0	**3**
4	18MCA44X	Elective – IV	MCA	3	0	0	**3**
5	18MCA45X	Elective – V (with Practice)	MCA	3	1	1	**5**
6	18MCA46	Minor Project– I	MCA	0	0	3	**3**
Total number of Credits				**15**	**1**	**6**	**22**
Total Number of Hours / Week (Counseling+ Placement Activity)				**15**	**2**	**12**	**31 (29+2)**

FIFTH SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Credits**
1	18MCA51	Software Project Management	MCA	3	0	0	**3**
2	18MCA52	Big Data Analytics	MCA	3	1	1	**5**
3	18MCA53X	Elective – VI	MCA	3	0	0	**3**
4	18MCA54X	Elective – VII (with Practice)	MCA	3	1	1	**5**
5	18MCA55	Seminar-1	MCA	0	0	2	**2**
6	18MCA56	Minor Project – II	MCA	0	0	4	**4**
Total number of Credits				**12**	**2**	**8**	**22**
Total Number of Hours / Week +Counseling				**12**	**4**	**16**	**32**

SIXTH SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Credits**
1	18MCA61	Project Viva	MCA	-	-	20	**20**
2	18MCA62	Seminar-2	MCA	-	-	2	**2**
Total number of Credits				**-**	**-**	**22**	**22**

SEMESTER: I					
DISCRETE MATHEMATICS (Theory)					
Course Code	**:**	**18MAT11**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:1:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 Hrs**
Set Theory : Sets and subsets, Set operations and the laws of set theory, Principle of inclusion and exclusion and Venn Diagrams, Generalization of principle of inclusion and exclusion	
Unit – II	**08 Hrs**
Relations and Functions Cartesian Product and relations, Properties of Relations, Zero-one matrices and directed graphs, Hasse diagram, Equivalence relations and partitions, Functions-types of functions, Special Functions, Function composition and Inverse function	
Unit – III	**08 Hrs**
Principle of counting The rules of sum and product, Permutations and Combinations-Combinations with repetitions, Derangements, Rook polynomials, Arrangements with Forbidden positions.	
Unit – IV	**08 Hrs**
Fundamentals of Logic Basic connectivity and Truth table, Logical equivalence, logical implications, Quantifiers – Definitions and Proofs of theorem.	
Unit – V	**08**
Graph Theory Definitions and Examples, Sub graphs , complements and Graph Isomorphism, Vertex Degree, Planar Graphs, Hamiltonian paths and circuits, Matrix representation-Incidence matrix and Adjacency matrix	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand fundamental concepts of sets, counting, logic, relations, functions and graph theory
CO2:	Apply fundamental concepts of sets, counting, logic, relations, functions and graph theory for different domains in computer science
CO3:	Analyze mathematical concepts like sets, counting, reasoning, relational algebra and graph theory to solve the problems and optimize the solution
CO4:	Implement overall mathematical knowledge gained to demonstrate and analyze the problems arising in practical situation

Reference Books	
1	Discrete and Combinatorial Mathematics. An applied Introduction, Ralph P Grimaldi, B.V.Ramana, 2007, 5th Edition, Pearson Education, ISBN-10:8177584243, ISBN-13:9788177584240
2	Discrete Mathematics, Seymour Lipschutz, Marc Lipson, Schaum's Outlines, 3rd Edition, 2007, McGraw-Hill, ISBN: 978-0-161587-7.
3	Discrete Mathematics & its Applications, Kenneth H Rosen, 7th Edition, 2010, McGraw-Hill, ISBN-10: 0073383090, ISBN-13: 978-0-073383095.
4	Geir Agnarsson & Raymond Greenlaw, "Graph Theory-Modeling, Applications and Algorithms", Pearson Education, 2008, ISBN - 978-81-317-1728-8.

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: I					
COMPUTER ORGANIZATION AND ARCHITECTURE (Theory)					
Course Code	**:**	**18MCA12**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**08Hrs**
Introduction to Boolean Algebra Number systems and Boolean Algebra: Number systems, binary codes, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Expression simplification using Boolean theorem and K-map.	
Unit – II	**07 Hrs**
Introduction to Digital Electronics Logic gates: Basic Gates, Universal Gate , the exclusive OR gate, Equivalence Gates. Combinational circuits: Adders, Sub tractor, Binary Parallel Adder, Decimal Adder, Decoders, Multiplexers. Sequential Circuits: Flip – Flops, Triggering of Flip- Flops.	
Unit – III	**08 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 Program Memory Operations, Instructions, Instruction Sequencing, Basic Input/output Operations, Introduction to Microprocessor based computer system.	
Unit – IV	**08Hrs**
IA-32 Architecture IA-32 Register Structure, IA-32 Addressing modes, Machine Instructions format, IA-32 instructions	
Unit – V	**08 Hrs**
IA-32 Programming Program Flow Control: Conditional and Unconditional Jumps, Shift and Rotate Instructions Programming examples.	

Course Outcomes: After completing the course, the students will be able to

CO1:	Illustrate the concepts of digital system, its organization and architecture
CO2:	Apply basic concepts of digital system and assembly language in solving problems
CO3:	Analyse the working of digital logic circuits and assembly language programs
CO4:	Justify the solutions selected for a problem

Reference Books

1.	Digital Logic and Computer design, M. Morris Mano, 2016, Pearson Education Ltd., ISBN: 13 9789332542525
2.	Computer Organization , Carl Hamacher, Z Varnesic and S Zaky, 5th Edition, 2012, Tata McGraw-Hill, ISBN: 13 9781259005275
3.	Fundamentals of Logic Design, Charles H. Roth, Jr. and Larry L. Kinney, 7th Edition 2014, Cengage Learning ISBN: 10:1-133-62847-8
4.	The Unabridged Pentium 4 IA32 Processor Genealogy, Bob Colwell and Tom Shanley, Addison-,2004,Wesley Professional, ISBN: 032124656X

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Evaluation (SEE): Theory (100 Marks) 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 full question from each unit..

SEMESTER: I					
DATA STRUCTURES USING C (Theory & Practice)					
Course Code	**:**	**18MCA13**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**08 Hrs**
Introduction to Data Structures and its types Types of Data Structures –Primitive , Composite and Abstract Data, Linear and Non-Linear Data Structures , Applications of Data Structures, Pointers and Dynamic Memory Allocation Linear Data Structures – Arrays: Static and Dynamic, Multi-Dimensional Arrays, Basic Operations on Linear Data Structures	
Unit – II	**08 Hrs**
Stacks and Queues Stacks, Applications of Stacks: Evaluations of Expressions, Queues, Circular Queues , Priority Queues	
Unit – III	**08 Hrs**
Linked Lists Singly Linked lists, Linked Stacks and Queues, Doubly Linked Lists, Circular Linked Lists	
Unit – IV	**08 Hrs**
Trees & Hashing Binary Trees, Binary Tree Traversals, Binary Search Trees ,Heaps, Hashing: Static Hashing	
Unit – V	**07 Hrs**
Graphs and Sorting Graph Abstract Data Type: Definitions, and Representations, Elementary Graph Operations: Depth First Search , Breadth First Search Sorting: Bubble Sort, Insertion Sort, Selection Sort	

Laboratory Component

1. Searching techniques using arrays (Linear and Binary)
2. Operations for a String based Stack
3. Evaluate postfix expression in a compiler
4. Basic queue operations
5. Task Scheduling using Priority Queues
6. Working of a singly linked list
7. Binary Search Tree traversal techniques
8. Sorting techniques (Bubble Sort, Insertion Sort, Selection Sort)
9. Depth First Search Traversal to identify the connectivity of a graph
10. Breadth First Search to display the reachable nodes

Note :
1.Experiment No.6, students are required to demonstrate any two operations specified by the examiners during CIE and SEE with display operation as a mandatory
2.Experiment No.8, students are required to demonstrate any two sorting technique specified by the examiners during CIE and SEE

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand data abstraction and data structures
CO2:	Identify relevant data structures to develop solutions for a particular problem
CO3:	Apply relevant data structures for different applications
CO4:	Examine the use of different data structures in various applications

Reference Books

1	Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson-Freed, 2nd Edition, 2012, University Press, ISBN: 978-81-7371-605-8
2	Data Structures and Alogorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 2013, Wiely Publications ISBN-10: 1118290275
3	Data Structures Using C and C++, YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tannenbaum, 2006, PHI publications, ISBN 10: 0130369977
4	The C Programming Language , Brian W. Kernighan , Dennis M. Ritchie , 2nd Edition, PHI Publications, ISBN-10: 0131103628 ISBN-13: 978-0131103627

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: I					
OBJECT ORIENTED PROGRAMMING (Theory& Practice)					
Course Code	**:**	**18MCA14**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:**	**3 Hrs(T) 3 Hrs (P)**

Unit – I	**08 Hrs**
Object oriented programming: Introductions, OOP, classes, class attributes, instances, instance attributes, Encapsulation, Basics of polymorphism: Operator and function overloading, Constructor and Destructor	
Unit – II	**08 Hrs**
Introduction to Python Programming Language, Introduction to python, program output, input, comments, operators, variables and assignment, numbers, if statement, while loop, for loop, and the range() , Data Types, Functions and Modules: Lists and tuples, working with strings, dictionaries, Functions and Functional programming,	
Unit – III	**08 Hrs**
Modules: What are modules, modules and files, Importing modules, packages**.** **Inheritance**: Introduction, types of inheritance, sub classing and scope, overriding methods	
Unit – IV	**07 Hrs**
Error and Exceptions: Lists and tuples, Working with Strings, Dictionaries, Introduction to exceptions in python, detecting and handling exceptions, context management, exceptions as strings, raising exceptions, assertions, standard exceptions.	
Unit – V	**08 Hrs**
Reading and Writing Files- Introduction to File operation, opening a File, Techniques for Reading Files, Writing Files. **Magic Methods** - Magic method syntax, Available Methods	

Laboratory Component

1. Implement importing of modules using OOPs concepts
2. Implement 10 operations on string and Tuple
3. Implement 10 operations on sets and dictionary
4. Design and develop pay band scale for N employees using dictionary
5. Implement Hierarchical Inheritance
6. Implement Multilevel Inheritance
7. Implement overriding concept
8. Demonstrate the magic methods usage: i)__getattr__ ii) __setattr__
9. Write a program to implement string manipulation using files

Demonstrate any five-exception handling mechanism

Course Outcomes: After completing the course, the students 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 for real world problem
CO4:	Analyze solutions using OOPs concepts for real world applications

Reference Books	
1	Beginning Python: from novice to professional, Hetland, Magnus Lie, 3rd Edition, Apress, ISBN 978-1-4842-0029-2, 2017
2	Professional Python, Sneeringer Luke, 2016, John Wiley & Sons, ISBN -978-1-119-07085-6.
3.	Practical Programming, Paul Gries, Jennifer Campbell, Jason Montojo, 2nd Edition, 2014 SHROFF Publishers and Distributors Pvt Ltd, ISBN: 13:978-93-5110-469-8,
4.	Core Python Programming, Wesley J Chun, 2nd edition, 2007 Pearson Education, ISBN 81-317-1188-9

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Examination (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: I					
WEB PROGRAMMING (Theory & Practice)					
Course Code	**:**	**18MCA15**	**CIE Marks**	**:**	**100 +50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 +50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:**	**3 Hrs(T) 3 Hrs (P)**

Unit – I	**08 Hrs**
Introduction to Web Technologies Internet, WWW, Web Browsers, Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. Multi-tier Application Architecture, Client-Side Scripting versus Server-Side Scripting. **Markup Language :** HTML5 tags - Formatting, Commenting, Code, Anchors, Backgrounds, Images, Hyper-links, Lists, Tables, Multimedia, Forms	
Unit – II	**08 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	**07 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**
Document Object Model: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, The DOM 2 Event Model, DOM Tree Traversal and Modification	
Unit – V	**08 Hrs**
Introduction to PHP: Origins and Uses of PHP, Overview of PHP , General Syntactic Characteristics, Primitives, Operations and Expressions, Output , Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Files, Cookies, Session Tracking	

Laboratory Component

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 selectors and Cascading style sheets
3. 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.
4. Develop and demonstrate a calculator using HTML5 file that includes JavaScript.
5. Write PHP code to change the background color of the page and display a welcome message including the given name submitted in the html form.
6. Write a Javascript program to display a digital clock which displays the current time of the server.
7. 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.
8. Write a PHP Program to demonstrate all the file operations
9. Demonstrate a login page using HTML5 and validate the username and password using PhP
10. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page. Also, store page views count in SESSION, to increment the count on each refresh, and show the count on web page.

Course Outcomes: After completing the course, the students will be able to

CO1:	Illustrate the fundamentals of web programming
CO2:	Apply the mark-up and scripting language concepts to build web applications
CO3:	Analyze appropriate content layout design and event handling techniques
CO4:	Implement server side utilities for dynamic real world environment

References Books

1	Programming the World Wide Web, Robert W. Sebesta, Pearson Education, 8th Edition, 2015 ISBN: 9780133775983
2	Web Technology Theory and Practice, M. Srinivasan, 1st Edition, 2012, Pearson Education, ISBN: 9788131774199
3	Internet and World Wide Web - How to Program, Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, 5th Edition, 2011 Pearson Education, , ISBN: 9780132151009
4	Web Programming Building Internet Applications, Chris Bates, 3rd Edition, 2006Wiley India, ISBN: 9780470017753

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Examination (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: II					
SOFTWARE ENGINEERING (Theory)					
Course Code	**:**	**18MCA21**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I — **10 Hrs**

Introduction & Software Process Models

Introduction: Professional Software Development, Software engineering and the Web, IEEE/ ACM code of software engineering ethics, Software Process models: waterfall, incremental development, Process activities: Coping with change, Plan-driven and Agile Development, Extreme Programming, Scrum; Case study- Develop Software Requirement Specification for any real world application (IEEE format)

Unit – II — **08 Hrs**

System Modeling, Design and implementation

System Modeling: Context models, Interaction models, Structural models, Behavioral models: Architectural Design: Architectural design decisions, Architectural patterns; Case Study-Develop Object oriented models for real world application

Unit – III — **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, SaaS

Unit – IV — **07 Hrs**

Software Testing, Project Planning and Management

Software Testing: Development testing, Test driven development, Release testing, User testing; Project Planning and Management: Risk management, Plan-driven development, Project scheduling, Estimation techniques; Case study-Generate test cases, cost and effort estimation for the problem identified

Unit – V — **07 Hrs**

Software Quality Assurance

Elements of Software quality assurance, SQA Tasks, Goals & Metrics, ISO 9001:2015 standards, quality management resources, Six Sigma

Course Outcomes: After completing the course, the students will be able to

CO1:	Interpret the basic concepts of Software Engineering and development process
CO2:	Demonstrate the phases of software development Life cycle, Concept of professional ethics using various system models
CO3:	Analyze and apply various testing techniques and Software project management strategies to build Quality Software products
CO4:	Examine Emerging Software Engineering concepts and methods for construction of efficient Software systems

Reference Books

1.	Software Engineering, Ian Summerville, Pearson Education Ltd, 10th Edition, 2015, ISBN : 9780133943030
2.	Software Engineering- A Practitioner's Approach, Roger S Pressman, Bruce R. Maxim, 8th Edition, 2015, McGraw-Hill, ISBN: 9780078022128
3.	Guide to the Software Engineering body of Knowledge version 3.0 SWEBOK,2014, E-Book: ISBN:9780769551661
4.	An Integrated Approach to Software Engineering, Pankaj Jalote, 3rd Edition, 2013,Narosa Publishing House, ISBN: 81-7319-702-4

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit..

SEMESTER: II					
E-COMMERCE (Theory)					
Course Code	**:**	**18MCA22**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:1:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**08 Hrs**
Introduction to E-Commerce Eight unique features of E-Commerce technology, Types of E-Commerce, E-Commerce Business Models, B2C Business Model, B2B Business Model, Case studies	
Unit – II	**08 Hrs**
Technology Infrastructure for E-Commerce Building an E-Commerce presence, Software and Hardware requirement, Case studies on Developing a mobile web site and building mobile applications, Case studies	
Unit – III	**08 Hrs**
Marketing and advertising Concepts Digital commerce marketing and advertising strategies, Internet marketing technology, Cost and benefits of online marketing communications, Social mobile and local marketing, Case studies	
Unit – IV	**08 Hrs**
e-Commerce Security and Payments Security threats in the e-commerce environment, Management policies, business procedures, E-commerce payment systems, Social, Mobile and Local marketing, Case studies	
Unit – V	**07 Hrs**
Ethical and Social issues in E-Commerce Understanding Ethical and social issues in e-Commerce, Privacy and information rights, Intellectual Property rights, Case studies	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamentals of e-commerce in business
CO2:	Apply e-commerce initiatives in various Business applications
CO3:	Analyze challenges for e-commerce models
CO4:	Evaluate E-commerce business applications

Reference Books	
1.	E-commerce BusinessTechnology Society, Kenneth C. Laudon, Carol Guercio Traver, 10th edition,2016, Pearson, ISBN 10th edition,2016, 978-93-325-5673-7.
2.	Ecommerce strategy, Technology & Implementation, Gary P. Schneider, 2008, ISBN-13 : 978-81-315-0533-5.
3.	E-Commerce: Fundamentals and Applications, Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, 2003, John Wiley & Sons, ISBN: 9780471493037
4.	1. Management Information Systems, James A O'Brien and George M Marakas, 10th Edition, 2008, Tata McGraw Hill, ISBN -13: 978-1-25-902671-3, ISBN-10: 1-25-902671-X

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Evaluation (SEE): Theory (100 Marks) **Theory:** The question paper will be set for maximum of 100 marks and shall consist of TEN questions from FIVE units with 20 marks each. Out of the ten questions, students must answer FIVE questions; one from each unit. The questions will have Internal Choice with maximum 3 sub divisions. The duration of the SEE will be for 3 hours.

SEMESTER: II					
DATABASE SYSTEMS (Theory & Practice)					
Course Code	**:**	**18MCA23**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

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	**08 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	**08 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	**07 Hrs**
Transaction Processing and Concurrency Control Introduction-Properties of Transaction, Serializability, Concurrency Control, Locking Mechanisms, Two Phase Commit Protocol, Dead lock	

Laboratory Component

1. Consider a scenario on Employee Management Database and perform the following
    i. Identify the Entities, attributes, relationships, cardinality and participation
    ii. Design the ER diagram and map it to schema diagram
    iii. Create the tables and populated them with appropriate data
    iv. Design the solution for the following
        a. List the employee name and salary is increased by 25% and expressed as Dollars.
        b. Display the average salaries of all the employees who works as ANALYST
        c. List the employees who are not working in the department FINANCE
        d. List the details of the departments where maximum number of employees are working
        e. List the name, salary, and commission for those employees whose net pay are greater than or equal to the salary of any other employee in the company.
        f. List the department where there are no employees (use Join)

Additional queries

1. List the managers who are senior to ALEX and who are junior to ANDREW.
2. Display the unique department of the employees
3. List the details of the senior employees as on year 1991.
4. List the name and average salary of employees in department wise.
5. list the name and salary of ANEESA if her salary is equal to maximum salary of her grade
6. List the department number, name, designation, salary, and net salary (salary + commission) of the SALESMAN who are earning maximum net salary
7. Find the most recently hired employees in each department order by joining date
8. List the name of the employees for their manager LENIN and also the name of the manager of LENIN
9. List the name of the managers who is having maximum number of employees working under him
10. List the name of the departments where more than average number of employees are working
2. Consider a scenario on Movie Database and perform the following
    i. Identify the Entities, attributes, relationships, cardinality and participation
    ii. Design the ER diagram and map it to schema diagram

iii. Create the tables and populated them with appropriate data

iv. Design the solution for the following

a. Find the movies which was released before 1998

b. Find the name of the director (first and last names) who directed a movie that casted a role for 'Eyes Wide Shut'

c. Find the reviewer's name and the title of the movie for those reviewers who rated more than one movie

d. Find all the years which produced at least one movie and that received a rating of more than 3 stars

e. List all the actors who acted in a movie before 1990 and also in a movie after 2000 (use Join)

f. Compute a report which contains the genres of those movies with their average time and number of movies for each genre (use Join)

Additional Queries

1. Find the titles of all movies directed by the director whose first and last name are Ronnie William
2. Find the titles of all movies that have no ratings
3. Find the titles of all movies directed by carl Hamacher.
4. Find the names of all reviewers who have ratings with a NULL value
5. Retrieve the reviewer name, movie title, and stars for those movies which reviewed by a reviewer and must be rated. Sort the result by reviewer name
6. Find the movie title, and the highest number of stars that movie received and arranged the result according to the group of a movie and the movie title appear alphabetically in ascending order
7. Find the titles of all movies which have been reviewed by anybody except by Allen Timpson
8. list all the information of the actors who played a role in the movie 'SILVER LINE'
9. Find the movie title, actor first and last name, and the role for those movies where one or more actors acted in two or more movies
10. Retrieve the reviewer name, movie title, and stars in an order that reviewer name will come first, then by movie title, and lastly by number of stars (use join)

3. Consider a scenario on Hospital Database and perform the following

3. Identify the Entities, attributes, relationships, cardinality and participation
4. Design the ER diagram and map it to schema diagram
5. Create the tables and populated them with appropriate data
6. Design the solution for the following

a. Find the name and medication for those patients who did not take any appointment

b. Find out the floor where the minimum no of rooms are available

c. Obtain the nurses and the block where they are booked for attending the patients on call (use Join)

d. Find the name of the patients who taken an advanced appointment, and also display their physicians and medication

e. Find the name of the patients, their treating physicians and medication

f. Generate a report which will show - name of the patient, name of the physician who is treating him or her, name of the nurse who is attending him or her, which

treatment is going on to the patient, the date of release, In which room the patient has admitted and which floor and block the room belongs to respectively
Additional Queries
1. Find the floor and block where the room number 104 belongs to
2. Count the number of unavailable rooms
3. Find the name of the nurse who are the head of their department
4. Find all the information of the nurses who are yet to be registered
5. Obtain the name of the physicians who are trained for a special treatment
6. Count the number of patients who taken appointment with at least one physician
7. Obtain the name of the physicians who are not a specialized physician
8. Obtain the name of the physicians with department who are yet to be affiliated
9. Count number of unique patients who got an appointment for examination room C
10. Find the name of the patients and the number of physicians they have taken appointment

Course Outcomes: After completing the course, the students 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 relational database for any given problem
Reference Books	
1	Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 6th Edition, 2011, Pearson Addison Wesley, ISBN 13: 978-0-136-08620-8
2	Database Systems Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6th Edition, 2010, McGraw-Hill Education, ISBN 0-07-352332-1
3	Database Management System, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, 2003, Mc Graw-Hill, ISBN-10: 0072465638
4	Modern Database Management, Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden, 8th Edition, Prentice Hall, ISBN-13: 978-0-13-033969-0

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Examination (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: II					
OPERATING SYSTEMS (Theory & Practice)					
Course Code	**:**	**18MCA24**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I	**08 Hrs**
Introduction to Operating Systems Operating system objectives and functions, Unix – architecture, features, General purpose utilities, File system, Basic file attributes, Simple filters: head, tail, cut, paste, fork, sort, tr, grep, sed	
Unit – II	**08 Hrs**
Process Management Process, Process States, Process Description, Process Control, System call – fork, exec Process Scheduling: Basic Concept, Scheduling Criteria and Algorithms	
Unit – III	**08 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	**08 Hrs**
Memory Management Swapping, Contiguous Memory Allocation, Paging, Segmentation, Demand Paging, Page Replacement and Allocation of Frames	
Unit – V	**07 Hrs**
File and Disk Management Implementing File systems: Directory Implementation, Allocation Methods, Free Space Management, Secondary Storage Structure: Disk Structure, Disk Scheduling and Disk Management, Case Study – RTOS	

Laboratory Component	
1. Write a shell script to implement the following tasks a) Count the files with read only permission for all users. b) Display directory/file properties with formatted output c) Display the current week of the month, with replacement of current date to '*' d) Convert range of lines from a file into toggle case and store it in another file 2.Write a program to implement copy command 3.Write a program using fork() system call that generates Fibonacci series in the child process. 4.Implement future knowledge algorithm and non preemptive SJF and make the comparison 5.Implement FCFS and Round Robin algorithms 6.Implement producer-consumer problem using semaphore 7.Write a program to simulate the MFT (Multiprogramming with Fixed number of tasks) memory management technique 8.Write a program to implement FIFO, LRU and Optimal Page Replacement algorithm with a memory reference string with three frames 9.Implement Linked List File Allocation techniques 10.Implement disk scheduling Algorithms **(Note : For Program No: 8 and 10 Implement Any Two in CIE/SEE)**	
Course Outcomes: After completing the course, the students will be able to	
CO1:	Define the structure of an operating system components and its responsibilities
CO2:	Analyze the structure and design decisions involved in the implementation of an operating system
CO3:	Design and Demonstrate general solutions for the issues involved in the management of an operating system
CO4:	Implement and manage the computer resources like memory, storage devices, processes, file systems and users
Reference Books	
1	2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, 2012, Pearson, ISBN:978-93-325-1880-3
2	Operating System Concepts , Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th Edition, 2010, John Wiley, ISBN :978-81-265-205-0
3	Unix Concepts and Applications, Sumitabha Das, 4th Edition, 2012, Mc Graw Hill, ISBN:978-0-07-063546-3
4	Real –Time Operating Systems For ARM Cortex-M Microcontrollers - Embedded Systems, Jonathan W Valvano, Volume 3, 4th Edition, 2017, ISBN: 978-1463590154

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Examination (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: II					
JAVA PROGRAMMING (Theory & Practice)					
Course Code	**:**	**18MCA25**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**07 Hrs**
Java Programming Fundamentals: Introduction to Java Programming, Applications of Java Programming, The Java Development Kit, The Java Keywords, Identifiers in Java, User input using Scanners, The Java Class Libraries. Java's Primitive Types, The Scope and Lifetime of Variables, operators, Type Casting, Operator Precedence, Expressions, Conditional and Control Statements, Arrays, String Handling	
Unit – II	**07 Hrs**
Classes, Objects and Methods: Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, The new operator Revisited, Garbage Collection and Finalizers, this Keyword, Recursion, Understanding Static.	
Unit – III	**10 Hrs**
Inheritance, Interface, Packages: Inheritance: Fundamentals, Overloading, Overriding, super keyword, Using final. Interface: Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces. Package : Fundamentals, Importing Packages, Creating user defined packages	
Unit – IV	**07 Hrs**
Exception Handling and Multithreading: Exception Handling: Fundamentals, Hierarchy, Catching subclass Exceptions, try blocks can be nested, Throwing an Exception, Throwable, using finally, using throws, Java's Built-in Exceptions. Multithreaded Programming: fundamentals, Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Thread Priorities, Thread Synchronization, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.	
Unit – V	**08Hrs**
I/O, Applets: The Java I/O Classes and Interfaces, File Handling, Input stream and Output stream.Applet: fundamentals, Architecture, Applet Skeleton, Applet Initialization and Termination, Requesting Repainting, using the status window, Passing parameters to Applets, event handling, Layouts.	

Laboratory Component
1. Write a JAVA Program to demonstrate Constructor Overloading and Method overloading 2. Write a Java program to demonstrate the methods in String and StringBuffer a. Write a JAVA Program to demonstrate Inheritance b. Write a Java program to demonstrate Multiple inheritance using interface. 3. Demonstrate the usage of packages in java programing by creating a package containing geometrical figures and calculating their area. Import and compile classes in other program 4. Write a JAVA program to demonstrate the usage of user defined Exception Handling (also make use of throw, throws.) 5. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept 6. Write a JAVA program to demonstrate the Thread priority by creating three different thread and changing its priority in another program. 7. Write a JAVA Program to demonstrate read, write and append operations on files 8. Write a JAVA applet program, which handles keyboard event. 9. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the + – * % operations. Add a text field to display the result.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamentals of Java Programming
CO2:	Design a Java program efficiently by using its features
CO3:	Implement and Develop software using Java programming
CO4:	Demonstrate various Java features in building applications
Reference Books	
1	Java Fundamentals, A Comprehensive Introduction , Herbert Schildt, Dale Skrien, 2013,Tata McGraw Hill Edition, McGraw Hill Publication, ISBN-13:9781249006593
2	Java: The Complete Reference 9th, Schildt, Herbert, 2014, McGraw-Hill Education Group, ISBN:0071808558 9780071808552
3	Object-Oriented Programming and Java, Danny Poo, Derek Kiong, Swarnalatha Ashok, 2nd edition, 2009, Springer science and business media, ISBN: 978-81-8489-235-2
4	Object oriented programming through Java, Krishna, P. Radha, 2007, CRC Press, Inc., ISBN: 8173715726

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

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The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: III					
RESEARCH METHODOLOGY (Theory)					
Course Code	**:**	**18MCA31**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3Hrs**

Unit – I	**07 Hrs**
Introduction - Meaning of Research, Types of Research, Research and Scientific method Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process **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, Important Concepts Relating to Research Design , Different research designs	
Unit – II	**08 Hrs**
Methods of Data Collection-Experiment and Surveys, Collection of Primary data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case study	
Unit – III	**08 Hrs**
Design of Sample Surveys-Sample Design, Sampling and Non sampling Errors, Sample survey v/s Census Survey, Types of Sampling Designs, Probability and Non-probability sampling, Complex Random Sampling Designs	
Unit – IV	**08 Hrs**
Data Preparation - Data Preparation Process, Some Problems in Preparation Process, Missing Values and Outliers, Types of Analysis, Statistics in Research, **Descriptive Statistics -** Measures of Central Tendency (Mean, Median, Mode, Other averages), Measures of Dispersion (range, mean deviation, statistical deviation)	
Unit – V	**08 Hrs**
Testing of Hypothesis – Basic concepts concerning testing of hypothesis, Testing the hypothesis Test statistic and critical region, Critical value and decision rule, Hypothesis Testing of Mean, Hypothesis Testing of Proportion, Hypothesis Testing of Variance **Essential Report Writing**- Interpretation of research output, Significance of Report Writing, Layout of the Research Report	

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand various principles and concepts of research methodology to solve research problems
CO2:	Identify appropriate method for collecting the data and solve the problems
CO3:	Implement the research method to collect the data , find solution and interpret the outputs
CO4:	Analyze the research methods to collect, apply, interpret and depict the research data

Reference Books

1	Research Methodology Methods and Techniques, Kothari CR, 3rd Edition, 2014 New Age International, ISBN : 978-81-224-3623-5
2	Management Research Methodology, Krishnaswami KN, Sivakuma AI and Mathiarajan, 2009, Pearson Education, ISBN : 9788177585636
3	Statistics for Management, Levin RI and Rubin, 7th Edition, Pearson Education New Delhi, ISBN : 9788177585841
4	Probability and Statistics, Murray R Spiegel, John J Schiller and R Alu Srinivasan, 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi, ISBN:978007015154

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: III					
ANALYSIS AND DESIGN OF ALGORITHMS (Theory & Practice)					
Course Code	**:**	**18MCA32**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 HRS (P)**

Unit – I	**07 Hrs**
Introduction to Algorithms, Brute Force Technique & Divide and Conquer technique Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms **Brute Force Technique** : Sequential Search and Brute force string matching **Divide and Conquer** : Merge Sort, Quick Sort and its performance	
Unit – II	**08 Hrs**
Decrease-and-Conquer & Greedy Method Insertion Sort, Topological Sorting, Algorithms for generating combinatorial objects Knapsack Problem, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths	
Unit – III	**08 Hrs**
Dynamic Programming Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, 0/1 Knapsack, The Travelling 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	**08 Hrs**
Backtracking and Branch - Bound Technique Backtracking: n – Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem, Branch and Bound-Assignment Problem, Travelling Salesman Problem	

Laboratory Component

Students are required to implement the following using C

1. Implement String pattern matching using Brute force technique and find the time complexity for different inputs
2. 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.
3. Obtain the Topological ordering of vertices in a given digraph using Source removal 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. Implement 0/1 Knapsack problem using Dynamic Programming.
7. Find the transitive closure and shortest path among all pairs in a given graph
8. Apply input enhancement technique to search the given pattern from a string and find the time complexity of the same
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.

Course Outcomes: After completing the course, the students 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)
CO3:	Implement and apply various techniques for efficient algorithm design
CO4:	Analyze and evaluate the algorithms based on the order of notation and performance metrics
Reference Books	
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, 2016, Person Education, ISBN-13: 9780321358288
2.	Fundamentals Of Computer Algorithms, Ellis Horowitz,Sanguthevar Rajasekaran,Sartaj Sahni, 2nd Edition, 2004, Galgotia Publications, ISBN 13: 9788175152571
3.	Essential Algorithms A Practical Approach to Computer Algorithms, Rod Stephens, 2013, Wiley Publications, ISBN: 978-1-118-61210-1
4.	Analysis and Design of Algorithms A Beginner's Approach, Rajesh K. Shukla, 2015, Wiley Edition: ISBN 13: 9788126554775

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: III					
COMPUTER NETWORKS (Theory & Practice)					
Course Code	**:**	**18MCA33**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**07 Hrs**
Introduction- Introduction, Uses of Computer Networks, Network Hardware, Network Software: Protocol Hierarchies, Design Issues for the Layers, Reference Models: The OSI Reference Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models, Example Networks: Internet, Architecture of the Internet, Who's Who in the International Standards World **Physical Layer-**Guided Transmission Media, Digital Modulation and Multiplexing	
Unit – II	**08 Hrs**
Data Link Layer-Data Link Layer Design issues, Error Detection codes, Sliding Window Protocols (Stop and Wait, Go-Back-N (GBN) and Selective Repeative (SR)) **Medium Access Control**-The Channel Allocation Problem, Multiple Access Protocols, Ethernet	
Unit – III	**08 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, Congestion Control Algorithms, Quality of Service, Internetworking, The Network Layer in the Internet: The Network Layer in the internet- IP version 4 Protocol, IP version 6 protocol: The Main IPv6 Header, Extension Headers, Internet Control Protocols: ICMP—The Internet Control Message Protocol, ARP—The Address Resolution Protocol, DHCP—The Dynamic Host Configuration Protocol	
Unit – IV	**08 Hrs**
The Transport Layer-The Transport Service: Services Provided to the Upper Layers, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols- TCP: Introduction to TCP, The TCP Service Model, UDP	
Unit – V	**08 Hrs**
The Application Layer-The Domain Name System, Electronic Mail, The World-Wide-Web, Streaming Audio and Video	

Laboratory Component

1. Create a LAN with three or more nodes implementing star topology in it. Demonstrate class full Addressing in it
2. Create a LAN using physical networks/virtual Machine and install FTP server to demonstrate file transfer.
3. Demonstrate secured file transfer and computing over wired Network and wireless Network
   a. using SCP command to move files from one computer to another
   b. SSH key based computing.
4. Demonstrate packet forwarding from one LAN to another LAN using IP Forward
5. Build DHCP server using dnsmasq with and without MAC binding
   a. IPV4
   b. IPV6 .
6. Build DNS server for resolving the names and IP addresses
7. Demonstrate packet filtering in a firewall using iptables.
8. Build a firewall with SNAT/DNAT/PNAT using iptables . W
9. rite a program to demonstrate TCP echo Server and Client (using C / Python) .
10. Demonstrate Proxy - Server setup for a web server and SSH port forwarding

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify the design issues, services, interfaces, protocols and flow of data in computer networks
CO2:	Understand the elements and protocols for peer - peer and communication between layers
CO3:	Analyze the protocols and services designed for physical, data link, network and transport layers
CO4:	Evaluate the concepts, methods, principles and protocols in computer networking
Reference Books	
1	Computer Networks, Andrew S. Tanenbaum, David J Wetherall, Pearson Education, 5th Edition, 2012, Pearson Publication, 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
3	Computer networks: a systems approach, Peterson, Larry L., and Bruce S. Davie, Fourth Edition, 2007, Elsevier , ISBN-13: 978-0123705488
4	Data and computer communications, Stallings, William, Fourth Edition, 2007, Pearson Education India, ISBN: 0-13-243310-9

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: III					
NON-RELATIONAL DATABASES (NOSQL) (Theory)					
Course Code	**:**	**18MCA341**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:1:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3Hrs(T) 3Hrs(P)**

Unit – I	**07 Hrs**
Introduction to 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	**08 Hrs**
Understanding the Storage Architecture - Working with column- oriented databases, HBase distributed Storage Architecture, Document store internals, Understanding Key/Value stores in Memcached and Redis **Performing CRUD Operations -** Creating Records, Accessing Data, Updating and Deleting Data.	
Unit – III	**08 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 **Managing Transactions-** RDBMS and ACID, Distributed ACID systems, Upholding CAP.	
Unit – IV	**08 Hrs**
Gaining Proficiency with NOSQL- Using NOSQL in the CLOUD, Scalable Parallel Processing with Map Reduce, Surveying Database Internals – MongoDB internals, Hypertable under the Hood, Apache Cassandra, Berkeley DB.	
Unit – V	**08 Hrs**
Developing and Administration- PhP and MongoDB, Python and MongoDB, creating blog application with PHP Drive, Database Administration.	

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand different types of NoSQL databases
CO2:	Illustrate the different operations to manage databases
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	Professional NOSQL, Shashank Tiwari, 2011, Wiley India Private Limited, ISBN: 99788126533268
2	The Definitive Guide to MongoDB, TheNOSQL Database for Cloud and Desktop Computing, Eelco Plugge, Peter Membrey and Tim Hawkins, Apress2010, ISBN: 978-1-4302-3052-6. (E-Book)
3.	NOSQL FOR DUMMIES, Adam Fowler, 2015, A Wiley Brand John Wiley &Sons, Inc., ISBN 978-1-118-90574-6 (pbk); ISBN 978-1-118-90562-3 (epub); ISBN 978-1-118-90578-4 (epdf)
4.	Eric Redmond and Jim R. Wilson "Seven Databases in Seven Weeks", A Guide to Modern Databases and the NOSQL Movement The Pragmatic Bookshelf Dallas, Texas • Raleigh, North Carolina 2012, ISBN-13: 978-1-93435-692-0

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: III					
OPERATIONS RESEARCH (Theory)					
Course Code	**:**	**18MCA342**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:1:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**08 Hrs**
Introduction to Operations Research & LPP-Introduction, Operations Research models, Solving the OR model, 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	**07 Hrs**
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	**08 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	**08 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	**08 Hrs**
Non-Linear Programming –Meta heuristics The Nature of Metaheuristics: Non-linear programming Problem, Travelling Salesman Problem - Sub Tour reversal algorithm, Tabu Search: Minimum spanning tree, Simulated Annealing: Travelling Salesman Problem, Genetic Algorithms: basic concept	

Course Outcomes: After completing the course, the students 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

References Books	
1	Operations Research - An Introduction, Hamdy A Taha, 9th Edition, 2014, Pearson, ISBN: 978-93-325-1822-3, First Impression
2	Introduction to Operations Research, Frederick S. Hillier & Gerald J. Lieberman, 8th Edition, 2007, Tata McGraw Hill, ISBN-10: 0070600929, ISBN-13: 978-0070600928
3	Wayne L Winston, "Operations Research :Applications and Algorithms", Thomson Course Technology, 2003, 4th Edition, ISBN-13:978-0534380588, ISBN-0534380581
4	Operations Research, Prem Kumar Gupta, D S Hira, 5th Edition,2014, S.Chand & Company Pvt Ltd., ISBN10:8121902819, ISBN 13:9788121902816

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: III					
MACHINE LEARNING (Theory)					
Course Code	**:**	**18MCA343**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:1:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3Hrs**

Unit – I	**07 Hrs**
Introduction to Machine Learning: Introduction to Machine learning - Human learning, machine learning, types, problems not to be solved using machine learning, Application, Issues **Preparing to Model:** Machine learning activities, Basic type of data in Machine learning, Exploring structure of data, Data quality and Remediation,	
Unit – II	**08 Hrs**
Modelling and Evaluation: Pre-processing. Selecting the Model, Training the Model, Model Representation and Interpretability, Evaluating performance of a model **Basics of Feature Engineering :** Introduction ,Feature Transformation, Feature Subset Selection	
Unit – III	**08 Hrs**
Supervised learning **Bayesian Concept –** Bayes theorem and concept learning - Brute force Bayesian algorithm, Naïve Base Classifier **Classification**: Classification Model, Classification learning steps, Classification Algorithms-k-nearest Neighbour(kNN), Decision Tree, Random Forest Model, Support Vector Machines	
Unit – IV	**08 Hrs**
Regression: Introduction, Examples of Regression, Regression Algorithms- Simple Linear Algorithms, Multiple Linear Regression, Assumption in Regression Analysis, Main Problems in Regression Analysis, Logistic Regression **Unsupervised learning :** Introduction, Unsupervised/s supervised learning, applications of Unsupervised Learning, Clustering- Clustering as a machine learning task, different types of clustering techniques, Partitioning methods, K-medoids, Hierarchical clustering, Density based Methods – DBSCAN Finding Pattering using Association Rule	
Unit – V	**08 Hrs**
Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity Based Approaches	

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand the need of data and pre-processing, machine learning techniques for various application
CO2:	Identify and apply the appropriate techniques to process the data and solve the applications using machine learning techniques
CO3:	Implement machine learning techniques for various problems
CO4:	Evaluate the different data processing and machine learning techniques for various application

Reference Books

5.	Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, 1st Edition, 2019, Pearson Publications, , ISBN 978-93-530-6669-7
6.	Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber Jian Pei, 3rd Edition, Morgan Kaufmann publications, ISBN 9780123814791
7.	Machine Learning, Tom M Mitchel, McGraw Hill publications,ISBN-0070428077
8.	Elements of statistical learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second Edition, Springer Series in Statistics, Springer publications.

Continuous Internal Evaluation (CIE): Theory (100 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

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 full question from each unit.

SEMESTER: III					
CONTENT MANAGEMENT SYSTEM (Theory & Practice)					
Course Code	**:**	**18MCA351**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**4:0:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I **10 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 **11 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 – III **11 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 – IV **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 – V **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?

Laboratory Component

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. a.Demonstarte 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
|- Achievements
|-Faculty
|-Placements

|-ISE
|-MCA

KEY EXECUTIVES
CONTACT US
5. 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.

6a. Demonstrate backup update and restore of drupal websites.
b. Install drush and demonstrate drush commands to enable, disable, download modules and clearing caches

7. Enable the following core module and configure the following:
a. Poll
b. Blog
c. Forum
Demonstrate the above modules with appropriate contents

8.Build a website using drupal for a school. The pages should have the following
1. Proper headings, Links for more details
2. Images where ever appropriate

3. Displaying the school curriculum
4. Provision to take feedback from the users and Validate important fields

9.Create a navigation menu having titles About Us, Authorities, Administation, Academics, Examination and Departments in Word Press. The sub-menu are as follows:
About Us – Objectives, Students Enrollment, 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, Soft skills
Examination – Results, Time table, syllabus copy
Departments – Architecture, Biotech, Civil, Computer Science, Electronics

10. Build a website using Wordpress for a Product Based Company. The pages should have the following
1. Proper headings, Links for more details
2. Images where ever appropriate
3. Displaying types of products and their prices
4. Provision to take feedback from the user and Validate important fields

Course Outcomes: After completing the course, the students will be able to

CO1:	Compare and Contrast between various content management systems
CO2:	Enabling and configuring interactive capabilities
CO3:	Demonstrate critical thinking skills to design and create different contents
CO4:	Design and create personal and /or business websites

Reference Books

7.	Web Content Management: Systems, Features, and Best Practices, Deane Barker, 1st Edition, 2016, O'Reilly Media, Inc., ISBN 978-1-4919-0812-9
8.	Todd Tomlinson, Beginning Drupal 7,1st Edition, Apress Publishing Company, ISBN-13 (pbk): 978-1-4302-2859-2
3.	Professional WordPress: Design and Development, Brad Williams, David Damstra, Hai Stern, 3rd Edition, 2015, Wrox Publications, ISBN: 978-1-118-98724-7
4.	Programmer's Guide to Drupal, Jennifer Hodgdon, 2nd Edition, 2015, O'Reilly Media, ISBN-13:9781491911464

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)
CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project
Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Practical: CIE for practical consists of continuous evaluation of the programmes in the lab during every lab hour. Every programme is evaluated for 10 marks and consolidated for 40 marks. One lab internal is conducted at the end of the semester for 50 marks and reduced to 10 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)
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 full question from each unit.
Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: III					
ADVANCED OOPS (Theory & Practice)					
Course Code	**:**	**18MCA352**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**4:0:1**	**SEE Marks**	**:**	**100+50**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I **10 Hrs**

Introduction to Advanced Object Oriented Programming

Decorators: Understanding Decorators, Decorator Syntax, Where Decorators are used, Why you should write Decorators, When you should write Decorators, Writing Decorators, decorator classes. **Context Managers:** Context manager syntax, when you should write context managers. **Generators**: Understanding what a Generator is, Understanding Generators syntax, communication with generators, alterable vs iterators, generators in standard library.

Unit – II **10 Hrs**

Meta Classes, Abstract Base Class: Meta classes Classes and Objects, Writing Meta classes, When to Use Meta classes. **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.

Unit – III **11 Hrs**

OOP for Database Programming: Introduction- Persistent Storage, Basic 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 – IV **11 Hrs**

OOP for 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 and Partial Function Application.

Unit – V **10 Hrs**

OOP for Web Development: Web Frameworks: Django Introduction, Web Frameworks, Introduction to Django, Projects and Apps, "Hello World" Application. Creating a Model to add database service, Python Application Shell , Creating Blog's User Interface.

Laboratory Component

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. 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 class.
3. Define a class factory which demonstrates the runtime attributes during the class creation.
4. Write a Python program to demonstrate the Abstract Classes.
   Example: create a class with abstract execute method and __init__ method which accepts the operand_a and operand_b. Derive abstract class which is overriden by the execute method based on the operations which is being performed.

5. Write a python program to demonstrate connection to database and retrieving information.
   Example: create menu driven program which will demonstrate the add, display and delete the record of an employee table created using database MYSQL with attributes slno, name, address, emp-code, date of birth, age, mobile, status, designation
6. Write a GUI application using TKinter with username, password, submit button and clear button. When the submit button is clicked an appropriate message should be displayed.
7. Demonstrate Conversion table with a Tkinter GUI
   (Any one of the Conversion table to be considered for exams)
   Metric Conversion (gram to ounce, kilo to pounds, tonne to stone)
   Temperature Conversion (Celsius to Fahrenheit)
8. Design a canvas using TKinter to animate an moving car.
9. Demonstrate with the Django framework, a registration page for alumni meet for college and display the same in the next page using Django framework
10. Demonstrate with the Django framework, Insert, fetch the employee details from MYSQL database using ORM.

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand advanced concepts of OOP with TKinter, database and Django
CO2:	Apply advanced concepts of OOP in TKinter, database and Django
CO3:	Analyze the standard way of developing applications using TKinter, Django and database
CO4:	Develop application using advanced OOP in Tkinter, Django and database

Reference Books

1	Professional Python, Luke Sneeringer, 2016, Wrox, Wiley India Pvt ltd, ISBN:978-81-265-5895-7
2	Core Python Application Programming, Wesley J. Chun, Third Edition, 2016Pearson, ISBN:978-93-325-5536-5
3	Practical Programming, Paul Gries, Jennifer Campbell, Jason Montojo, Edited by Lynn Beighley,,Second Edition, 2013, The Pragmatic BookShelf, ISBN: 9781937785451, 1937785459
4	The Definitive Guide to Django: Web Development Done Right, Adrian Holovaty, Jacob Kaplan-Moss, Second Edition, 2009, Apress, ISBN: 978-1430219361

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Practical: CIE for practical consists of continuous evaluation of the programmes in the lab during every lab hour. Every programme is evaluated for 10 marks and consolidated for 40 marks. One lab internal is conducted at the end of the semester for 50 marks and reduced to 10 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: III					
MODEL VIEW CONTROLLER PROGRAMMING (Theory & Practice)					
Course Code	**:**	**18MCA353**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**4:0:1**	**SEE Marks**	**:**	**150**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I	**10 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 Developing Node.js web application, connecting and mounting middleware.	
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	**11 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() **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 – IV	**11 Hrs**
Introducing AngularJs: Key concepts of AngularJs, Modules, Dependency injection in AngularJs, Directives, installing AngularJs using with Bower, structure and bootstrap the application, Angular MVC entities, ngRoute module, Services **Implementing the AngularJS module views**- The create-article view, The view-article view, The edit-article view, The list-articles view	
Unit – V	**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	

Laboratory Component
1. Write a node.js program to create a custom middleware functions that outputs the current URL and time stampto the console 2.Write a node.js program to calculate area or three geometrical objects using modules. 3.Write a node.js program using express framework accept USN, Name, branch and marks validate name and mark fields (Name should not empty and marks should be integer) 4.Write a node.js program using Express framework to accept user name, Branch, Semester, from web page and display the information as below a) Handle both get and post methods b) Branch should be underlined c) Name should be in bold face. 5.Write a node.js program using Express framework to display different categories of products from flipcart/Amazon (Note: Use Routing, Min:3 products) 6.Using node.js and Mongo create a database called 'FinalYears. Create a collection 'Student' with 'USN', 'Name' and company_name (by campus selection) as fields. Write a node.js program to insert and display the list of students who are selected for 'Microsoft'. 7.Using Node.js and mongo, develop a program to accept 'Employee' information namely Emp name, Emp code, Dept, Basic Salary from a web page and to store the information in a database and update the salary with the name specified by the user. 8.Write a controller using AngularJs for the student information namely USN, Name, branch, Semester for inserting , editing, deleting and updating. 9.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. 10.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. **Note : Students are required to implement all the programs**

Course Outcomes: After completing the course, the students 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	MEAN Web Development, Amos Q Haviv,2014, PACKT Publication, ISBN 978-1-78398-328-5
2	Getting MEAN with Mongo, Express, Angular, and Node, Simon Holmes, 2015, MEAP Edition November, ISBN 9781617292033.
3	PRO MEAN STACK DEVELOPMENT, Elad Elrom, 1stEdition, 2016, APRESS publications, ISBN-13:978-1484220436,
4	Write Modern Web Apps with the MEAN Stack, Jeff Dickey, 1st Edition, 2015, ISBN-13:978-0133930153

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

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Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: IV					
SOFTWARE TESTING AND PRACTICES (Theory & Practice)					
Course Code	**:**	**18MCA41**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**3:0:1**	**SEE Marks**	**:**	**100 +50**
Total Hours	**:**	**39L+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I	**07 Hrs**
Basics of software testing - Basic Definitions, Test Cases, Preparing a Test Plan, Insights from a Venn Diagram, Identifying Test Cases, Fault Taxonomies, Levels of Testing; Examples: The Triangle Problem, The NextDate Function, The Commission Problem; Case study- Develop test cases for any real world application using test case description template	
Unit – II	**08 Hrs**
Boundary value testing, Equivalence class testing, Decision table based testing-Normal, Robust Boundary value testing, Examples, Random testing, Traditional and Improved Equivalence class testing, Equivalence class test cases examples- triangle problem, NextDate function, Decision Table Techniques, Decision Table Test cases for triangle problem	
Unit – III	**08 Hrs**
Path Testing, Data flow testing, Life Cycle–Based Testing-Program Graphs, DD Paths, Basis path testing, Define/Use Testing, Slice-Based Testing, Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing	
Unit – IV	**08 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, Non-functional System Testing	
Unit – V	**08 Hrs**
Testing Automation-Automation test life cycle,writing test cases using unit test:setUp() method, tearDown() methods, Finding Web elements: Using ID,name attributes, class name, tag name, Xpath; Synchronizing Tests:Implicit wait, explicit wait; test Suite automation **Case study:** Perform Code coverage analysis, Pass/Fail data flow, Control flow analysis, Unit testing, Integration testing using LDRA testing tool	

Laboratory Component	
Design and write programs using Python for manual testing and Selenium to implement the automation testing Pre-requisite: Students are required to design and develop a sample webpage in order to implement the automation programs 6 to 10 1. Write a Program to demonstrate decision table-based testing. Develop various test cases, execute them and analyze the test results 2. Write a Program to demonstrate boundary value testing. Generate test cases for normal and boundary value testing. Execute the test cases and discuss test results 3. Write and execute test cases from the perspective of equivalence class testing for any real world. Analyze the test results 4. Demonstrate dataflow testing with a case study. Derive different test cases, execute the test cases and analyze the test results 5. Implement basis paths testing. Derive different test cases, execute the test cases and discuss the test results 6. Write and execute test cases to demonstrate unit test automation concept 7. Write and execute test cases to find web elements using ID, name attributes, class name, tag name, Xpath and display the count 8. Write and execute test cases to create, update and validate the contents of an Excel file. 9. Develop and execute a test Suit automation concept 10. Write and execute test cases to read and validate the contents of a webpage	
Course Outcomes: After completing the 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 result analysis and automation process using testing tools
Reference Books	
1	Software Testing, A Craftsman's Approach, Paul C. Jorgensen, 4th Edition, First Indian Reprint, 2014, Auerbach Publications, ISBN-13:9781466560680
2	Learning Selenium Testing Tools with Python, Unmesh Gunecha, 2014, PACKT Publishing, ISBN-13:9781783983506
3	Software Testing Principles and Practices, Srinivasan Desikan Gopalaswamy, 5th Edition, 2008 , Pearson Education, ISBN: 9788177581218
4	Software Testing Technique, Beizer Boris, 2nd Edition, 2008, Wiley India, ISBN-13: 9788177222609

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

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Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit..

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SEMESTER: IV					
MODERN APPLICATION DEVELOPMENT (Theory & Practice)					
Course Code	**:**	**18MCA42**	**CIE Marks**	**:**	**100+50**
Credits: L:T:P	**:**	**3:0:1**	**SEE Marks**	**:**	**100 +50**
Total Hours	**:**	**39L+26P**	**SEE Duration**	**:**	**3 Hrs (T) 3 Hrs (P)**

Unit – I	**07 Hrs**
Activities: Declaring an activity, Starting a new activity with an intent object, Switching between activities, Passing data to another activity, Returning a result from an activity, Understanding the activity life cycle **Views, Widgets, and Styles:** Inserting a widget into a layout, Using graphics to show button state, Creating a widget at runtime	
Unit – II	**08Hrs**
Menus and Action Mode: Creating and using a Fragment, Adding and removing Fragments during runtime, Passing data between Fragments **Alerts and Notifications:** Creating a Toast with a custom layout, Displaying a message box with AlertDialog, Displaying a progress dialog	
Unit – III	**08 Hrs**
Data Storage: Storing simple data, Read and write a text file to internal storage and external storage, Creating and using an SQLite database **Location and Using Geofencing:** How to get the device location, Creating and monitoring a Geofence	
Unit – IV	**08 Hrs**
Introduction to PWAs and Tooling: Introduction to Progressive Web Apps, Tools to Measure Progressive Web Apps **PWA Features:** Service Workers, Caching and Offline Functionality with Service Workers, Background Sync for Offline Apps with Service Workers	
Unit – V	**08 Hrs**
PWA Features: Adding your App to the Home Screen with Web App Manifest, Notifications, App Shell Architecture and Loading Performance, Exploring HTTP/2 and Server Push **Putting the Features to Use:** Turning a Real App into a PWA, PWAs From the Start **Leveling Up Your PWA:** Leveling Up Your PWA	

Laboratory Component

1. Create an application to obtain a signature on a canvas
2. Devise a Calculator App to perform basic arithmetic operations
3. Create a Mobile App to exhibit Recorder
4. Build an application to perform CRUD - i) Create and Read, ii) Create and Update, iii) Create and Delete operations on the information of automobiles on the database and email the details to the provided email address
5. Develop an application to send SMS to a particular contact from the Phonebook
6. Build mobile application to save GPS location information of a particular phone
7. Create a login page to authenticate an user using PWA
8. Build a simple web page using PWA
9. Devise a PWA to fetch the Github Details for a particular person
10. Build an application to do a stock display using PWA

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand Android applications work, Life cycle, Manifest, Intents, and using external resources
CO2:	Demonstrate Activities, Layouts, Views, Widgets, Menus and Notifications
CO3:	Identify communication abilities including SMS, the telephony APIs, network management with Data Storage
CO4:	Design and develop innovative applications with enhanced features

Reference Books	
1	Android 9 DevelopmentCookbook, Rick Boyer, 3rd Edition, 2018, Packt Publishing, ISBN – 13: 9781788622967
2	Beginning Progressive Web App Development: Creating a Native App Experience on the Web, Dennis Sheppard, 2017, Apress Publishing, ISBN: 9781484230909
3	Beginning Hybrid Mobile Application Development, Mahesh Panhale, 2016, Apres ISBN 978-1-4842-1314-8, DOI 10.1007/978-1-4842-1314-8
4	Beginning Android Application Development, Wei-Meng Lee 2011, Wiley, ISBN-13: 978-118017111

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

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Total CIE is 20(Q)+50(T)+30(A)=100 Marks

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Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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SEMESTER: IV					
INFORMATION RETRIEVAL (Theory)					
Course Code	**:**	**18MCA431**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 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 architecture? Basic Building Blocks, Breaking It Down	
Unit – II	**08 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	**08 Hrs**
Ranking with Indexes - Overview, Abstract Model of Ranking, Inverted indexes, Compression, Auxiliary Structures, Index Construction, Query Processing	
Unit – IV	**08 Hrs**
Queries and Interfaces- Information Needs and Queries, Query Transformation and Refinement, Showing the Results, Cross-Language Search	
Unit – V	**08 Hrs**
Retrieval Models - Overview of Retrieval Models , Probabilistic Models, Ranking Based on Language Models **Evaluating Search Engines-** Why Evaluate?, The Evaluation Corpus, Effectiveness Metrics, Efficiency Metrics	

Course Outcomes: After completing the course, the students will be able to

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

Reference Books

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

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Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit..

SEMESTER: IV					
PATTERN RECOGNITION (Theory)					
Course Code	**:**	**18MCA432**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 Hrs**
INTRODUCTION: Machine perception, pattern recognition systems, design cycle, learning and adaptation, Applications of pattern recognition.	
Unit – II	**08 Hrs**
STATISTICAL DECISION MAKING: Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, Characteristic Curves.	
Unit – III	**08 Hrs**
NONPARAMETRIC DECISION MAKING: Introduction, histograms, Kernel and window estimators, Adaptive Discriminant Functions, Minimum Squared Error Discriminant Functions. Nearest neighbour classification techniques	
Unit – IV	**08 Hrs**
LINEAR CLASSIFIERS Linear discriminant functions and decision hyper plane, perceptron algorithm, least squares methods, sum of error squares estimation, support vector machine – separable class, nonseparable classes,	
Unit – V	**08 Hrs**
ARTIFICIAL NEURAL NETWORKS Introduction, nets without hidden layers. Nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	State and illustrate pattern recognition and its broad applications in aspects of real world problems
CO2:	Recognize and examine the techniques used to recognize patterns, such as statistical approaches, data clustering and neural networks
CO3:	Apply performance evaluation methods for pattern recognition algorithm for detection and classification of different applications
CO4:	Summarize, analyze and critique comparisons of techniques used in pattern recognition systems

Reference Books

1	Pattern Classification, Duda R. O., and Hart P. E., and Stork D. G., 2nd Edition, 2007, Wiley Interscience Publishers,
2	Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh and Steve Jost, 2015 Pearson Education Inc.,
3	Pattern Recognition, SergiosTheodoridis, Konstantinos Koutroumbas, 2nd Edition, 2008 Elsevier Academic Press, Hardcover ISBN: 9781597492720
4	Pattern Recognition and Machine Learning, Christopher M Bishop, Springer Publications, ISBN-13: 978-0387310732, ISBN-10: 0387310738

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: IV					
SOFTWARE ARCHITECTURE (Theory)					
Course Code	**:**	**18MCA433**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 Hrs**
Introduction: What is software Architecture? What Software Architecture is and what it isn't, Architectural Structures and Views, Architectural Patterns, What Makes a " Good" architecture? **Why is Software Architecture Important:** Inhibiting or Enabling a System's Quality Attributes, Reasoning About and Managing change **The Many Contexts of Software Architecture:** Architecture in a Technical context, Architecture in a Project Life –Cycle context, Architecture in a Business Context, Architecture in a Professional Context	
Unit – II	**08 Hrs**
Quality Attributes : Understanding Quality Attributes, Architecture and Requirements, Functionality, Quality attribute considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions.	
Unit – III	**08 Hrs**
Quality Attributes Modeling and Analysis: Modeling Architectures to Enable Quality Attribute Analysis, Quality Attribute Checklists, Thought Experiments and Back-of-the Envelope Analysis, Experiments, simulations and Prototypes, Analysis at Different Stages of the Life Cycle	
Unit – IV	**08 Hrs**
A**rchitecture in Agile Projects**, How much Architecture?, Agility and Architecture Methods, A brief Example of Agile Architecting, Guidelines for the Agile Architect **Designing an Architecture :** Design strategy, the Attribute driven Design Method, The Steps of ADD	
Unit – V	**8 Hrs**
Architecture, Implementation and Testing: Architecture and Implementation, Architecture and Testing **Architecture Evaluation**: Evaluation Factors, The Architecture Trade off Analysis Method, Lightweight architecture Evaluation	

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand various architectural design concepts and its principles
CO2:	Analyze the required quality attributes for architectural design
CO3:	Apply architectural strategy to aid quality analysis
CO4:	Evaluate the architecture using various analysis methods.

Reference Books

1	Software Architecture in Practice, Len Bass, Paul Clements, Rick Kazman, 3rd Edition, Pearson Publishing, ISBN: 9789332502307.
2	Software Architecture: Perspectives on an Emerging Discipline, Mary Shaw, David Garlan, PHI Publishing, ISBN 9788120314702.
3	'Pattern- Oriented Software Architecture : A system of Patterns, Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Vol 1,Willy Student Edition, ISBN 9788126516117
4	Software Architecture Foundation, Richard N.Taylor, Nenad Medviovic, Eric M.Dashofy, Theory,and Practice", Wiley student edition ISBN 9788126528028

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: IV					
CYBER SECURITY (Theory)					
Course Code	**:**	**18MCA441**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 Hrs**

Introduction to Cyber Security

Defining Cyberspace and Cyber security, Standard of Good Practice for Information Security, ISO Suite of Information Security Standards, NIST Cyber security Framework and Security Documents, CIS Critical Security Controls for Effective Cyber Defence, COBIT 5 for Information Security, Payment Card Industry Data Security Standard

Unit – II	**08 Hrs**

System Access

System Access Concepts, User Authentication, Password-Based Authentication, Possession-Based Authentication, Biometric Authentication, Risk Assessment for User Authentication , Access Control, Customer Access

Unit – III	**08 Hrs**

Phishing and Identity Theft

Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits And Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle

Unit – IV	**08 Hrs**

Tools and Methods used in Cybercrime

Introduction, Proxy Server and Anonymizers, Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQLinjection, Buffer Overflow

Network Defence tools

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls

Unit – V	**08 Hrs**

Threat and Incident Management

Technical Vulnerability Management, Security Event Logging, Security Event Management, Threat Intelligence, Cyber Attack Protection, Security Incident Management Framework, Security Incident Management Process

Course Outcomes: After completing the course, the students will be able to

CO1:	Define and illustrate cyber security concepts and principles
CO2:	Analyse the working of cyber security principles to system design
CO3:	Apply appropriate techniques to solve cyber security threats
CO4:	Evaluate cyber security through network defence controls

Reference Books:

1	Effective Cybersecurity: A Guide to Using Best Practices and Standards, William Stallings, Addison-Wesley Professional, ISBN-13: 978-0134772806
2	Cyber Security, Nina Godbole & Sunit Belapure, Wiley India, 2012, ISBN: 9788126521791
3	Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, 4th Edition, Publication McGraw Hill, ISBN: 9789339212155
4	Cyber Security Understanding Cyber Crimes, Nina Godbole and SunitBelpure, Computer Forensics and Legal Perspectives, Wiley Publication, ISBN 9788126521791

Continuous Internal Evaluation (CIE): Theory (100 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project **Total CIE is 20(Q)+50(T)+30(A)=100 Marks**
Semester End Examination (SEE): Theory (100 Marks) 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 full question from each unit.

SEMESTER: IV					
SOFT COMPUTING (Theory)					
Course Code	**:**	**18MCA442**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**3:0:0**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3 Hrs**

Unit – I	**07 Hrs**

Artificial Neural Network

Fundamental Concept – Artificial Neural Network, Biological Neural Network, Brain Vs Computer; Important Terminologies of ANNs – Weights, Bias, Threshold, learning rate, Momentum Factor, Vigilance Parameter, Notations; Back Propagation Network- Theory, Architecture, Flow chart for Training Process, Training Algorithm, Learning Factors of Back Propagation Network, Testing Algorithm of Back Propagation Network

Unit – II	**08 Hrs**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets

Introduction to Fuzzy Logic, Classical Sets – Operators on classical sets, Fuzzy Sets- Fuzzy Set Operations, properties of Fuzzy Sets

Classical Relations and Fuzzy Relations

Introduction, Cartesian Product of Relation, Classical Relation – Cardinality of Classical Relation, Operations on Classical Relations, Properties of Crisp Relations, Composition of Classical Relations; Fuzzy Relations - Cardinality of Fuzzy Relation, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Composition

Unit – III	**08 Hrs**

Member Functions

Introduction, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Induction Reasoning

Unit – IV	**08 Hrs**

Defuzzification

Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods – Max-Membership Principle, Centroid Method, Weighted Average Method, Mean-Max Membership, Centre of Sums, Centre of Largest Area, First of maxima

Unit – V	**08 Hrs**

Genetic Algorithms

Biological Background – The Cell, Chromosomes, Genetics, Reproduction, Natural Selection; Traditional Optimization and Search Techniques, Genetic Algorithm and Search Space, Basic Terminologies in Genetic Algorithm – Individuals, Genes, Fitness, Populations; Operators in Genetic Algorithm ,Stopping Condition for Genetic Algorithm Flow

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand the fundamentals of Soft computing approaches and demonstrate the basic functionalities
CO2:	Apply the soft computing techniques to solve problems
CO3:	Analyze the results of soft computing techniques to handle various problems
CO4:	Evaluate the solutions of soft computing algorithms for optimization

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

Continuous Internal Evaluation (CIE): Theory (100 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

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 full question from each unit.

SEMESTER: IV					
UNIFIED MODELING LANGUAGE (Theory)					
Course Code	**:**	**18MCA443**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3:00 Hours**

Unit – I	**07 Hrs**

Introduction to UML and Structural Modelling

Importance and principles of modelling, object-oriented modelling, overview of the UML, conceptual model of UML, architecture, software development life cycle in object oriented approach

Classes, Relationships - dependency, generalization and association relationships, modelling simple dependencies, single inheritance and structural relationships.

Unit – II	**08 Hrs**

Introduction to UML Diagrams

Diagrams- Terms and concepts, structural diagrams, behavioral diagrams, modeling different views of the system, levels of abstraction and complex views

Class diagrams, modelling simple collaborations and logical database schema, forward and reverse engineering, advanced relationships- dependencies, generalizations, association classes, realizations, understanding the interface, modeling the seams in a system, packages, visibility, importing and exporting of packages

Unit – III	**08 Hrs**

Behavioural Modelling

Use case Diagrams, common properties and uses, modeling the context of a system, requirements of a system, forward and reverse engineering

Sequence diagrams, structured control in sequence diagrams, nested activity diagrams, modeling flows of control by time ordering.

Unit – IV	**08 Hrs**

Advanced Behavioural Modelling

Activity diagrams-actions, activity nodes, control flows, branching, forking and joining, swim lanes, expansion of regions, modelling the workflow and operation

State machines- states, transitions, advanced states and transitions, sub-states, modelling lifetime of an object

Deployment diagrams- common properties and uses, modelling an embedded system, client-server and fully distributed system

Unit – V	**08 Hrs**

Patterns

Introduction to patterns, modelling design and architectural patterns Structural patterns: composite, façade Behavioural patterns: command, observer Creational patterns: abstract factory, factory method

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand UML Concepts, modelling and its applications
CO2:	Examine the required behaviour and structure of the system to be designed
CO3:	Apply UML to solve modelling problems in Object oriented design
CO4:	Create UML models to produce, deploy and maintain software

Reference Books:	
1	The Unified Modeling Language User Guide, Grady Booch, James rumbaugh, Ivar Jacobson, 2nd Edition, 2007, Pearson Education, ISBN-81-317-1582-5, ISBN-13: 978-0321267979, ISBN-10: 0321267974
2	Design Patterns: Elements of reusable object-oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, 6th impression -2009 Pearson Education, ISBN- 978-81-317-0007-5
3	Learning UML 2.0, Kim Hamilton, Russell Miles, 2006, O'ReillyPub, ISBN-10: 0-596-00982-8, ISBN-13: 978-0-59-600982-3
4	UMLDistilled A Brief Guide to the Standard Object Modeling Language, MartinFowler, 3rd Edition, Addision-Wesley, ISBN-13: 978-0321193681, ISBN-10: 9780321193681
5	Pattern-Oriented Software Architecture, A System of Patterns, Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Volume 1, 2006, John Wiley and Sons, ISBN:978-81-265-1611-7.

Continuous Internal Evaluation (CIE): Theory (100 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

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 full question from each unit.

Semester: IV					
COMPUTER GRAPHICS (Theory & Practice)					
Course Code	**:**	**18MCA451**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**07 Hrs**
Introduction- 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	**08 Hrs**
Two Dimensional Geometric Transformations-Two Dimensional Translation, Rotation, Scaling, Reflection and Shear Geometric Transformation, Matrix Representations and Homogeneous Coordinates, Inverse Transformations	
Unit – III	**08 Hrs**
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	**08 Hrs**
Three Dimensional Geometric Transformations, Viewing and Curves-Three Dimensional Translation, Rotation, Scaling, Orthogonal Projection, Oblique Parallel Projection, Perspective Projection, Bezier spline curves	
Unit – V	**08 Hrs**
Computer Animation, Color Models- Raster methods for computer animation, Design of animation sequences, Traditional animation techniques, OpenGL interactive input device functions- GLUT mouse functions, GLUT keyboard functions, The RGB color model, The YIQ and related color model, The CMY and CMYK color models	

Laboratory Component

1. Write a program to implement Bresenham's line drawing algorithm.
2. Write a program to implement mid-point circle generation algorithm
3. Write a program to implement 2D geometric translation and scaling in X-Y Plane for the square object without using built-in function
4. Write a program to implement 2D reflection about X- axis, Y axis and X-Y Plane for the object triangle without using built-in function
5. Write a program to implement oblique parallel projections with angle 45^{o} for the object cube without using built in function
6. Write a program to implement 3D rotation for a given angle in X-Y Plane and around X- axis for the object triangle without using built-in function
7. Write a program to implement Bezier Curve algorithm with animation.
8. Write a program to display sun with animated rays using mouse events
9. Develop a 3D RGB color cube model with color animation
10. Develop a screen saver using geometrical objects

Note :

1. Programs can be executed using Open GL
2. During examination, each student picks one question from the lot of 10 questions and it has to be executed
3. No change of programs is permitted

Course Outcomes: After completing the course, the students 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	Computer Graphics with OpenGL, Donald D. Hearn, M. Pauline Baker, Warren Carithers, 4th Edition, 2014, Pearson Education, Second Impression, ISBN 978-93-325-1871-1
2	Interactive Computer Graphics – A Top down Approach using OpenGL, Edward Angel, Dave Shreiner, 6th Edition, 2012, Addison-Wesley, ISBN-13: 978-0-13-254523-5
3	Computer Graphics, Peter Shirley, Steve Marschner, 2009, Cengage Learning (India Edition), ISBN -13: 9788131512715
4	Open GL Programming Guide, Official guide to learning Open GL Version3.0 & 3.1, Dave Shreiner, 7th Edition, 2013, Addison-Wesley, ISBN 13: 978-0-321-55262-4

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Practical: CIE for practical consists of continuous evaluation of the programmes in the lab during every lab hour. Every programme is evaluated for 10 marks and consolidated for 40 marks. One lab internal is conducted at the end of the semester for 50 marks and reduced to 10 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: IV					
ADVANCED COMPUTER NETWORKS (Theory & Practice)					
Course Code	**:**	**18MCA452**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**07 Hrs**
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	**08 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	**08 Hrs**
Wireless LANS and PANS – Fundamentals of WLAN's, 802.11 Standards, HIPERLAN Standard, Blue tooth specifications, Transport Protocol group, ZigBee Specification **Wireless WANS and MANS** – The Cellular Concept and Cellular Architecture- Capacity enhancement .Channel Allocation Algorithms, Handoffs.	
Unit – IV	**08 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 and VPN with private address.	
Unit – V	**08 Hrs**
SDN - Introduction, Centralized and Distributed Control and Data Planes- Introduction, Control plane, Data plane, Moving Information Between Planes, Distributed Control Planes, IP and MPLS, Convergence Time, Load Balancing, High Availability.	

Laboratory Component

1. Created a LAN with 4 nodes implement star topology and demonstrate sub netted network.
2. Create a network with 3 or 4 nodes and do the following : i)Capture ICMP packets, ii)Capture UDP on specific interface, iii) Capture TCP and UDP packets, iv) Capture ipv6 packets.
3. Explore the features: Filters, flow graphs(TCP), statistics and protocol hierarchy in a network.
4. Create a network with 4 routers and 4 host on different networks and demonstrate RIP routing protocol.
5. Create a network with 4 routers and 4 host on different networks and demonstrate OSPF routing protocol.
6. Demonstrate the working of VLAN.
7. Create a wireless LAN with two access points and demonstrate wireless distributed network .
8. Create a network with clients & server and assign the IP. Demonstrate the collection of data from clients and store in server through socket programming.
9. Demonstrate of Peer-to-Peer Network for GNU-Linux Container based Application.
10. Demonstrate multi cast network for GNU-Linux Container based Application.

Course Outcomes: After completing the course, the students 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	The Complete Reference-Storage Networks, Robert Spalding, Indian Edition 2003, McGraw Hill Education, ISBN -13: 978-0-07-053292-2
2	Ad Hoc Wireless Networks Architecture and Protocols, C. Siva Ram Murthy, B. S. Manoj, 2011, Pearson Publication, ISBN 978–81-317-5905-9
3	Internet working with TCP/IP, Principles, Protocols, and Architectures, Douglas E Comer, Volume 1, 4th Edition, , 2001, Pearson Education, ISBN 81-7808-444-9
4	SDN: Software Defined Networks, Thomas D. Nadeau & Ken Gray, 2013, O'REILLY, ISBN-978-1-449-34230-2

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Practical: CIE for practical consists of continuous evaluation of the programmes in the lab during every lab hour. Every programme is evaluated for 10 marks and consolidated for 40 marks. One lab internal is conducted at the end of the semester for 50 marks and reduced to 10 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: IV					
ENTERPRISE APPLICATION PROGRAMMING (Theory & Practice)					
Course Code	**:**	**18MCA453**	**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	**:**	**3:1:1**	**SEE Marks**	**:**	**100 + 50**
Total Hours	**:**	**39L+26T+26P**	**SEE Duration**	**:** **:**	**3 Hrs (T)** **3 Hrs (P)**

Unit – I	**08 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 **Annotations:** What's the use of Annotation? Annotation basics, built in Annotation, Creating custom Annotations.	
Unit – II	**07 Hrs**
JDBC - Talking to Database, Immediate Solutions, Essential JDBC program, using prepared Statement Object, Interactive SQL tool. JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types, immediate solutions.	
Unit – III	**08 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	
Unit – IV	**08 Hrs**
JSP: 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 script lets. For example Using Scriptlets to make parts of JSP conditional, using declarations, declaration example, Including Files and Applets in JSP Documents.	
Unit – V	**08 Hrs**
JSP Directives: The JSP page directive, import attribute, session attribute, is Elign or attribute, buffer and auto flush attributes, info attribute, error Page and is error page attribute, is Thread safe attribute, extends attribute, language attribute, Including files and applets in jsp Pages, using java beans components in JSP documents **Understanding ORM:** Understanding Object relational Persistence – what is persistence?, ORM and JPA. Starting a Project: Introducing Hibernate, "Hello World" with JPA, Native Hibernate Configurations.	
Laboratory Component	
9. Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc...). 10. Write a JAVA Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such type of pages, you would need to refresh your web page regularly; Java Servlet makes this job easy by providing refresh automatically after a given interval). 11. Write a JAVA Servlet Program to implement and demonstrate get() and post() methods (Using HTTP Servlet Class)	

12. 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
13. Write a JAVA Servlet program to display all the methods which are present in ServletConfig and ServletContext
14. Write a JAVA JSP Program which uses <jsp:plugin> tag to run a applet
15. Write a JAVA JSP Program to remember user preferences using cookies
16. Write a JSP program to implement all the attributes of page directive tag
17. Write a JAVA JSP Program which uses jsp:include and jsp:forward action to display a Webpage
18. Write a Java Servlet Program to enter the login credentials and verify the same using hibernate frame work

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand the concepts of servlets, jsp and hybernate for enterprise applications
CO2:	Apply JAVA support and API skills for Enterprise Application Development
CO3:	Analyze the enterprise requirement to implement real world application
CO4:	Develop an enterprise application using servlets, jsp and hybernate

Reference Books

1	Designing Enterprise Applications with the Java TM 2 Platform, Inderjeet Singh, Beth Stearns, Mark Johnson and the Enterprise Team Enterprise Edition, 2nd Edition *ISBN*-10: 0201787903
2.	Java Fundamentals, A Comprehensive Introduction , Herbert Schildt, Dale Skrien, 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.	Java Persistance with Hibernate, Bauer, Christian, and Gavin King, 2nd edition, 2016, Dreamtech Press, ISBN-13: 978-9351199199

Continuous Internal Evaluation (CIE): Theory (100 Marks)+ Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Assignment(A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(A)=100 Marks

Practical: CIE for practical consists of continuous evaluation of the programmes in the lab during every lab hour. Every programme is evaluated for 10 marks and consolidated for 40 marks. One lab internal is conducted at the end of the semester for 50 marks and reduced to 10 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

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 full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

SEMESTER: IV

MINOR PROJECT – I
(Practice)

Course Code	**:**	**18MCA46**	**CIE Marks**	**:**	**100**
Credits: L:T:P	**:**	**0:0:3**	**SEE Marks**	**:**	**100**
Total Hours	**:**	**78P**	**SEE Duration**	**:**	**3 Hrs (P)**

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
5. The implementation of the project must be preferably carried out using the resources available in the department/college
6. Students are required to publish project findings in reputed journals/ conferences

Course Outcomes: After completing the 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

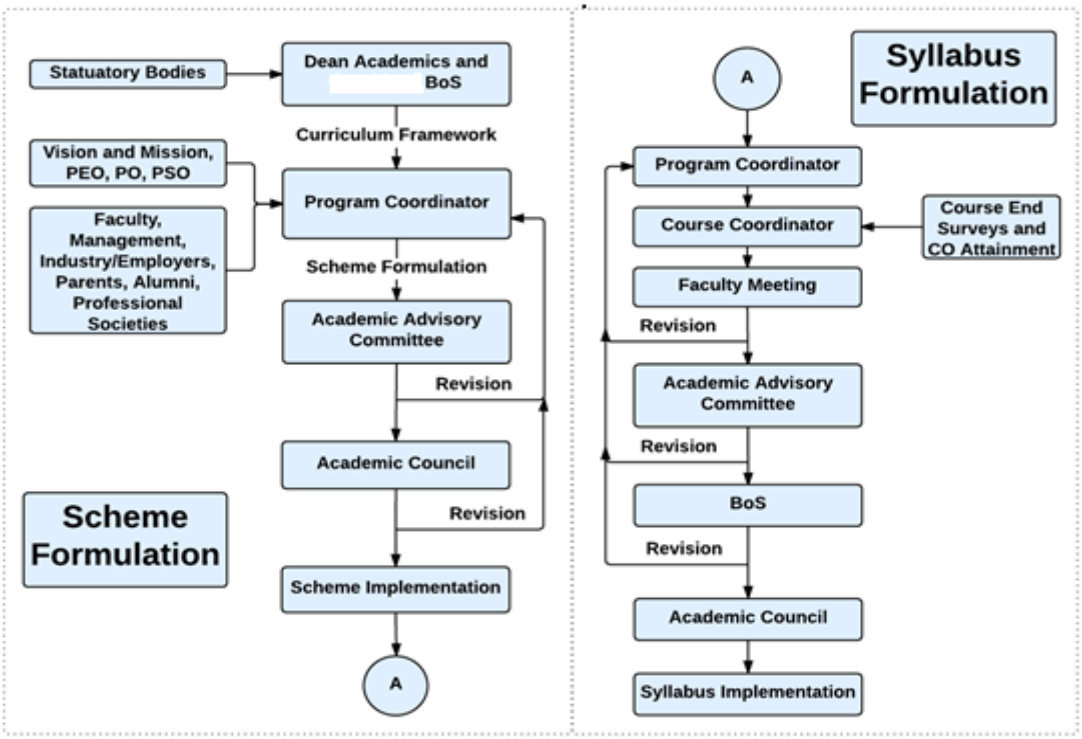
Scheme of Continuous Internal Examination (CIE)
Evaluation of the project work will be done by the committee appointed by the director, Dept of MCA. The student should submit report on the mini project work.
Evaluation will be carried out in THREE Phases.

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	20% 25%
III	Oral presentation Demonstration Project report& Paper publication	10% 10% 25%

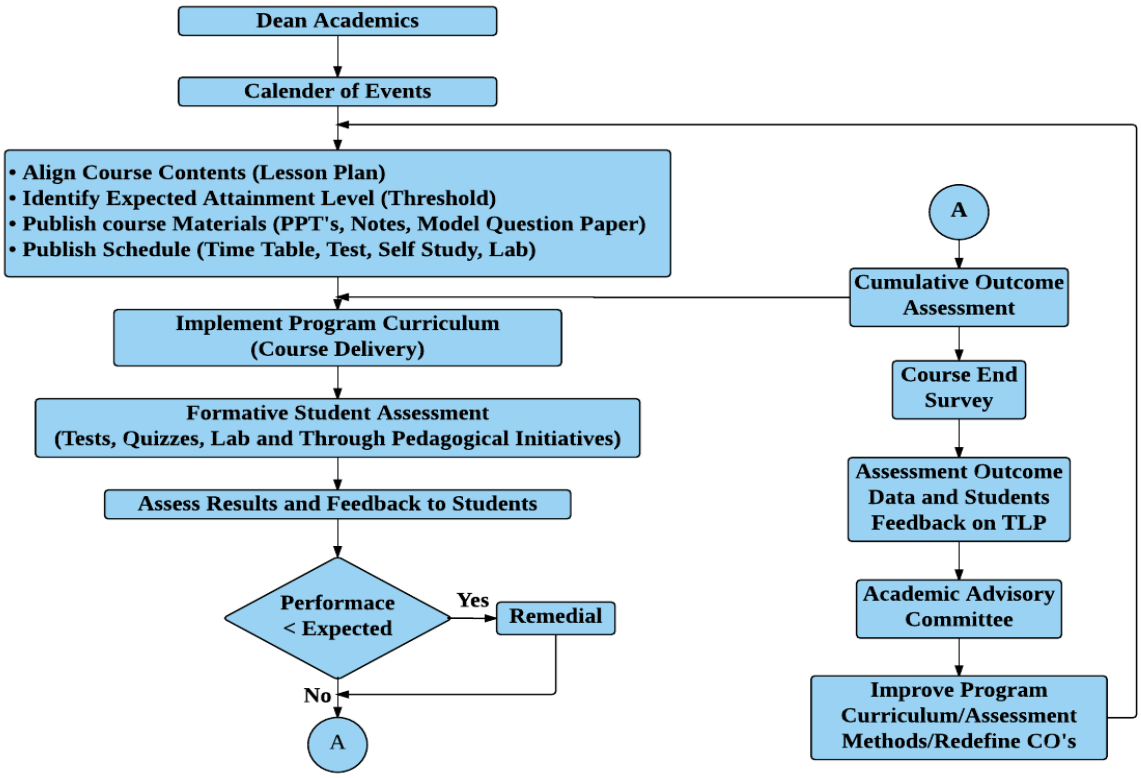
Scheme for Semester End Examination (SEE)
The evaluation will be done by Internal and External examiners. The following weightage would be given for the examination. Evaluation will be done in batches of 10 students.

1. Project work 40%
2. Presentation 30%
3. Viva-voce 30%

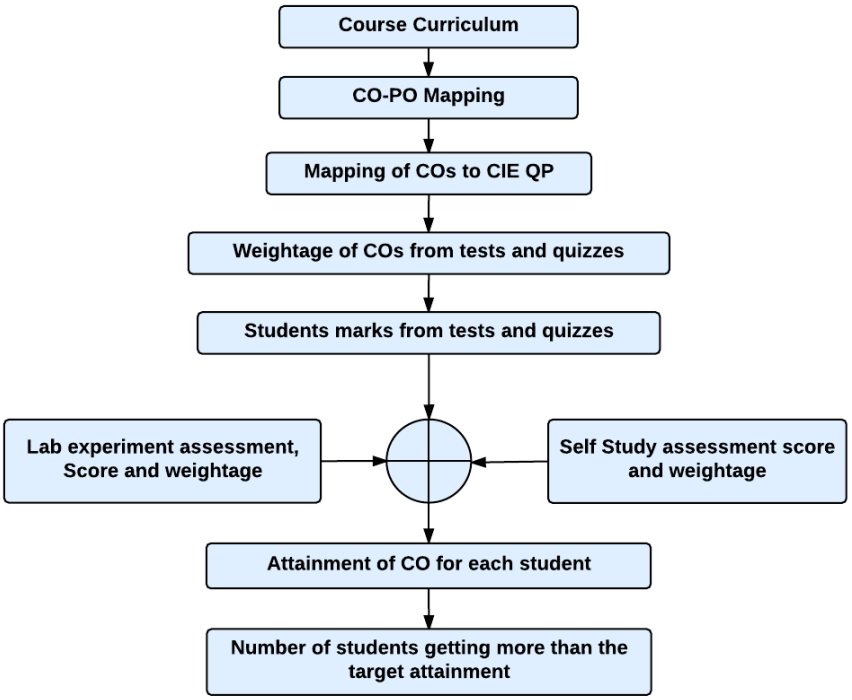
Curriculum Design Process



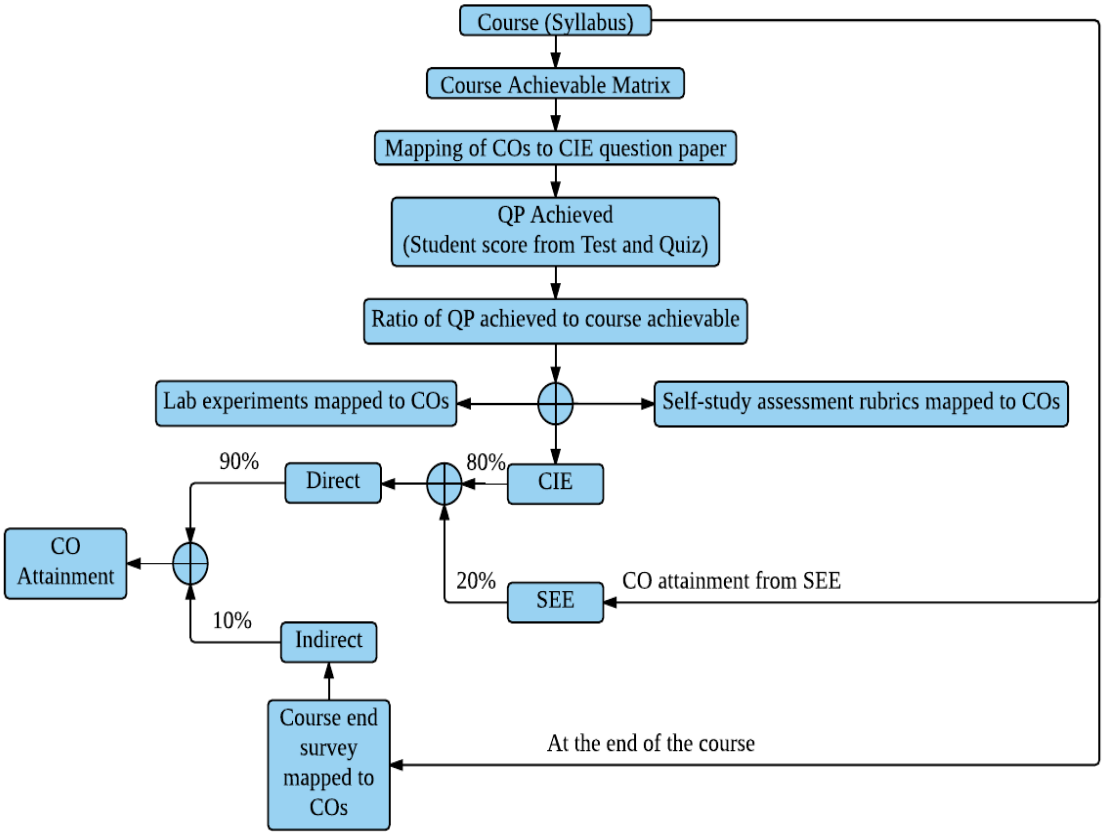
Academic Planning and Implementation



Process for Course Outcome Attainment



Final CO Attainment Process


Course (Syllabus)
Course Achievable Matrix
Mapping of COs to CIE question paper
QP Achieved
(Student score from Test and Quiz)
Ratio of QP achieved to course achievable
Lab experiments mapped to COs
Self-study assessment rubrics mapped to COs
90%
Direct
80%
CIE
CO
Attainment
20%
SEE
CO attainment from SEE
10%
Indirect
Course end
survey
mapped to
COs
At the end of the course

Program Outcome Attainment Process