ESTD. 1939

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY
"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
Approved by AICTE & UGC
Permanently Affiliated and Autonomous Institution Under
Visvesvaraya Technological University, Belagavi
www.git.edu

ESTD. 1979

2018-19 Scheme

Department: MCA

Programme: MCA

1rd to 6th Semester Scheme of Teaching and Examination

1st and 2nd Semester Syllabus

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become quality engineers with high standards of professionalism and ethics who have positive attitude, a perfect blend of techno-managerial skills and problem solving ability with an analytical and innovative mindset.

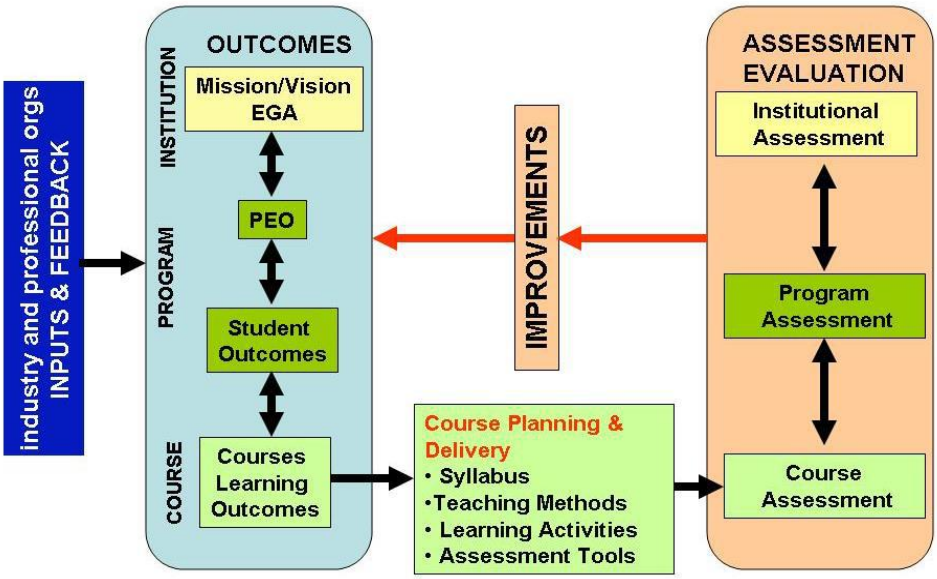
QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
The department of Master of Computer Applications shall strive to stand out as par excellence in generating and grooming, technically competent and skilled intellectual professionals to meet the challenges of the modern computing industry.

MISSION
To train the graduates to become IT professionals having strong fundamental knowledge in the field of computer application with ethical values to meet increasing global challenges of ever evolving technologies.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs) :

1. Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.
2. Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.
6. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.
7. Postgraduates will demonstrate knowledge of professional and ethical responsibilities.
8. Postgraduates will be able to communicate effectively in both verbal and written form.
9. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional.
10. Postgraduates will develop confidence for self-education and ability for life-long learning.
11. Postgraduates can participate and succeed in competitive examinations.
12. Postgraduates will use research-based knowledge and research methods including design of experiments,analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Real Life Problem Solving: Postgraduates of the programme will develop solutions to the real world problems by developing computer applications using the knowledge of mathematics, computer science and engineering in the diverse field of Information Technology.

PEO2: High-Quality Computer Professionals: The postgraduates shall practice and grow as computer professionals by conducting research, design, develop, test and maintain projects in varied fields of computer science and engineering using the state-of-the-art tools and technologies.

PEO3: Leadership Skills: The postgraduates will exhibit their leadership skills with ethics, integrity, competency and social responsibility.

PEO4: Lifelong Learning: The postgraduates shall always stand out of the crowd by enhancing their abilities in their profession through lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **PSO1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

2. **PSO2: Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality application for business success.

3. **PSO3: Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

PROGRAM SPECIFIC CRITERIA (PSCs):

PSC 1: Apply the knowledge of mathematics, computing and management through critical thinking in addressing the real time problems.

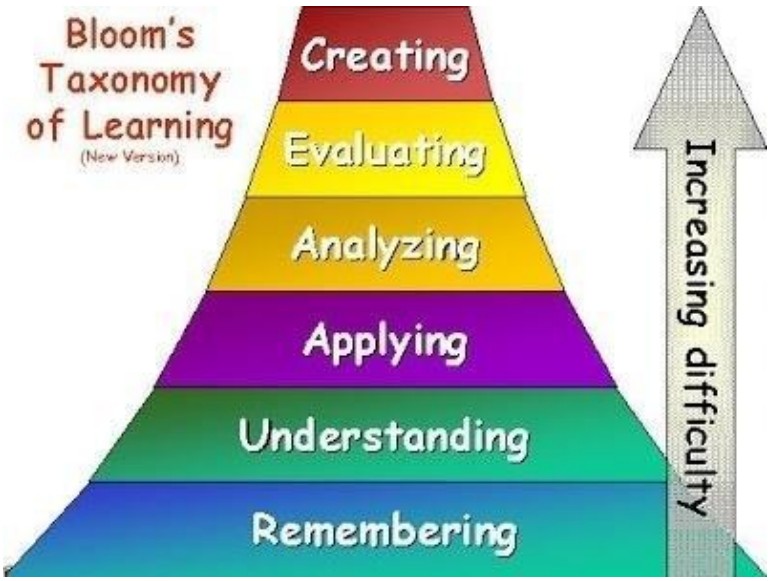
PSC 2: To design, analyze, model and realize physical systems, components or processes using modern software tools and technologies.

PSC 3: Prepare students to work professionally in multidisciplinary environments.

BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills(LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills(HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination -1st to 6thSemesterMCA

As per the guidelines of UGC CBCS the courses can be classified into:

(i) Core Courses (PC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

(ii) Foundation Courses: The Foundation Courses are of two kinds:

Compulsory Foundation: These courses are the courses based upon the content that leads to Knowledge enhancement.These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

(iv)Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining MCA Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for MCA program

Total credits for MCA Program: credits

		Regular batch		Lateral entry	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	23	44	--	--
	2	21		--	
2nd year	3	22	44	22	44
	4	22		22	
3rd year	5	21	44	21	44
	6	23		23	
	Total	**132**	**132**	**88**	**88**

Credit definition:

Lecture (L):One Hour /week – 1 credit

Tutorial (T): Two hour /week – 1 credit

Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination -1st to 6th SemesterMCA

I Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours /Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA11	Unix and Shell Programmin	CF	4-0-0	4	4	50	50	100
2	18MCA12	Web Programming	CF	4-0-0	4	4	50	50	100
3	18MCA13	Digital Systems and Computer Organization	CC	4-0-0	4	4	50	50	100
4	18MCA14	Data Structures	CC	4-0-0	4	4	50	50	100
5	18MCA15	Discrete Mathematical Structures	CC	4-0-0	4	4	50	50	100
6	18MCA16	Unix& Shell Programming Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA17	Web Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA18	Data Structures Laboratory	CC	0-0-2	2	1	50	50	100
			Total	**20-0-6**	**26**	**23**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial
P:Practical **CC:** Core Course **CF:**Compulsory Foundation

II Semester

Sl. No.	Course Code	Course Title	Cate gory	L-T-P	Contact Hours /Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA21	Programming using Java	CC	4-0-0	4	4	50	50	100
2	18MCA22	Database Management Systems	CF	4-0-0	4	4	50	50	100
3	18MCA23	Operating Systems	CC	4-0-0	4	4	50	50	100
4	18MCA24	Computing for Data Analytics	CC	3-0-0	3	3	50	50	100
5	18MCA25	Software Engineering	CC	3-0-0	3	3	50	50	100
6	18MCA26	Java Programming Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA27	Database Management Systems Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA28	Software Engineering & Testing Lab	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial
P:Practical**CC:** Core Course **CF:** Compulsory Foundation

III Semester

Sl. No	Course Code	Course Title	Category	L-T-P	Contact Hours /Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA31	Computer Networks	CF	4-0-0	4	4	50	50	100
2	18MCA32	Python Programming	CC	4-0-0	4	4	50	50	100
3	18MCA33	Cloud Computing	CC	4-0-0	4	4	50	50	100
4	18MCA34	Introduction to server-sideprogramming usin PHP	CC	4-0-0	4	4	50	50	100
5	18MCA35X	Elective – 1	FE	3-0-0	3	3	50	50	100
6	18MCA36	Computer Networks Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA37	Python Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA38	PHP Programming Laboratory	CC	0-0-2	2	1	50	50	100
		Total		**19-0-6**	**25**	**22**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective

Certification Courses: 2-credits

- Two certifications are compulsory and need to be completed before start of 6th semester.
- Choose certifications, which have industrial acceptance.
- Students have to submit the certificates with valid score of the certifications they have completed to the department during 6th semester. **This is mandatory for the award of the credits and degree.**
- These certifications are evaluated by a panel formed at college level during 6th semester for the award of 2 credits.

Elective Group

Note: Students are advised to select any one subject from the following elective group for Elective-1

Elective Group-1

Sl. No.	Course Code	Course Title
1	351	System Software
2	352	Linux Administration
3	353	Enterprise Resource Planning
4	354	Object Oriented Modeling and Design patterns

IV Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA41	Analysis and Design of Algorithms	CC	4-0-0	4	4	50	50	100
2	18MCA42	Programming Using J2EE	CC	4-0-0	4	4	50	50	100
3	18MCA43	Introduction to Big Data paradigm	CC	4-0-0	4	4	50	50	100
4	18MCA44X	Elective – 2	GE	3-0-0	3	3	50	50	100
5	18MCA45X	Elective – 3	GE	3-0-0	3	3	50	50	100
6	18MCA46	Algorithms Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA47	J2EE Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA48	Big Data Laboratory	CC	0-0-2	2	1	50	50	100
9	18MCA49	Communicative English	CF	1-0-0	2	1	50	--	50
			Total	**19-0-6**	**25**	**22**	**450**	**400**	**850**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical

CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective**GE:** Generic Elective.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-2 and Elective-3 respectively.

Elective Group-2

Sl. No.	Course Code	Course Title
1	441	Advanced Database Management System
2	442	Internet Of Things
3	443	Software Project Management
4	444	Soft Computing

Elective Group-3

Sl. No.	Course Code	Course Title
1	451	Information Storage Network
2	452	Application Development using MVC Frameworks
3	453	Client-Server Computing
4	454	Digital Marketing

V Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/ Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA51	Mobile Application Development	CC	4-0-0	4	4	50	50	100
2	18MCA52	.NET Programming using C#	CC	4-0-0	4	4	50	50	100
3	18MCA53	Machine Learning	CC	4-0-0	4	4	50	50	100
4	18MCA54X	Elective – 4	GE	3-0-0	3	3	50	50	100
5	18MCA55X	Elective – 5	GE	3-0-0	3	3	50	50	100
6	18MCA56	Mobile Application Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA57	C# Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA58	Project Work-1	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical

CC: Core Course **GE:** Generic Elective

Recommended to publish paper of Mini project work in any reputed journals like IEEE/ Springer/Elsevier (Science Direct)/Scopus/DBLP indexed conference etc.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-4 and Elective-5 respectively.

Elective Group- 4

Sl. No.	Course Code	Course Title
1	541	Advance Computer Networks
2	542	Cyber security and cyber Laws
3	543	Virtual Reality
4	544	Services Oriented Architecture

Elective Group- 5

Sl. No.	Course Code	Course Title
1	551	Web 2.0 and Rich Internet Applications
2	552	Information Retrieval
3	553	NoSQL
4	554	Wireless and Mobile Computing

VI Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks		Total Marks
								Demonstration, Presentation and Viva	Dissertation	
1	18MCA61	Internship	CC	NA	Full Time	4	50	--	--	50
2	18MCA62	Project Work-2	CC	NA	Full Time	15	50	100	50	200
3	18MCA63	Seminar	SC	NA	2	2	50	-	-	50
4	18MCA64	Certification-1 (Cambridge /Technical Certification)	CC	NA	1	1	--	--	--	--
5	18MCA65	Certification-2 (Technical Certification)	CC	NA	1	1	--	--	--	--
Total				NA	--	23	150	100	50	300

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Compulsory Core **SC:** Seminar Component **NA:** Not Applicable

18MCA64 and 18MCA65: Certification Courses

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1st and 2nd Semester Syllabus

Unix and Shell Programming (Theory)

Course Code	**18MCA11**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To focus on history, architecture, the file system, process, editors, command usage, filters, regular expressions and other utility tools in Unix system.
2. To explore the fundamentals of Unix command set and their usage to provide sufficient knowledge on writing scripts with different Unix languages.

Pre-requisites : --

Unit – I **10 Hours**

Introduction of UNIX, Files and File Organization: Brief History, Introduction to Unix and its Components, Using Unix, Commands in Unix, Some basic commands, Getting help, Command substitution, Giving multiple commands, Aliasis. Unix files, Categories of Files, Hidden Files, the file system, path names, the Home directory, directory commands, The dot and Double dot file names, File related commands, wild cards-Filename generation, displaying the contents of a file, Printing of files, Comparing files

Unit – II **11 Hours**

Basic File Attributes, The shell: Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find. The shell as command processor, Escaping. **Standard I/O, redirection Pipes:** Standard I/O, Redirection, Pipe & Pipeline, Mixing inputs from standard input and a file, tee commandTerminal (/dev/tty) and Trash(/dev/null) files.

Unit – III **11 Hours**

Shell Programming: Shell variables, The export command, The .profile file, read command, positional parameters, the $? Variable, set command, exit command, Branching Control Structures, Loop-Control Structures, The continue & break statements, The expr command, real arithmetic in shell programs, here document, sleep command, debugging scripts, script command.

Unit – IV **10 Hours**

Simple Filters and Regular Expressions: cut, paste, sort, uniq, tr commands, Filters using Regular Expression: grep –searching for a pattern, options, Regular Expressions-Round one & two, egrep, fgrep, sed-The stream editor, Line Addressing, Inserting and Changing Text, Context addressing, editing text, substitution, IRE, TRE

Unit – V **10 Hours**

The Process, AWK-Advanced filter: Meaning, Parent and Child processes, types of processes, More about foreground and Background processes, internal and external commands, the ps command, process creation, The nohup command, The nice command, Signals, trap, sty, kill, wait commands, Job control, command history, Scheduling jobs' execution.

Syntax of an awk program statement, structure of an awk script, operational mechanism of awk, variables, records, fields and special variables, Addressing-Line and Context, Patterns, Operators, Sample input files, awk control structures, Functions in awk, Executing awk scripts with the Shell, Arrays.

Text Books	
1.	M.G.Venkateshmurthy, Introduction to Unix& Shell Programming, Pearson publication 2006
2.	Sumitabha Das, Your Unix-The Ultimate Guide, Tata McGraw Hill 2001
3.	ForouzanGilberg, "Unix and Shell Programming", Cengage Learning 2003

Course Outcome (COs)

	At the end of the course, the student will be able to	Bloom's Level
1.	**Make Use of** the fundamental UNIX concepts, architecture and features of UNIX operating system and demonstrate the flexibility of command usage.	L 3
2.	**Classify** the file types with different file attributes and demonstrate file-handling techniques.	L 4
3.	**Utilize** the concepts of pipes and filters like grep, sed using basic and extended regular expressions.	L 3
4.	**Design** Shell programs for solving various problems using essential and advanced features of shell programming.	L 6
5.	**Identify**kernel's role in Process Management & job scheduling process.	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Web Programming (Theory)

Course Code	**18MCA12**	**Credits**	4
Course type	CF	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear understanding of Web Technologies.
2. To emphasize the basics of HTML, JavaScript and XML.
3. To impart the knowledge of programming using XHTML, JavaScript and XML.
4. To explore simple JavaScript user interfaces and introduce development of platform independent web applications using LAMP Standard development kit.

Unit – I 10 Hours

Fundamentals, Web Foundations: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox**.**
Evolution of the Web, Peak into the History of the Web, Internet Applications, Networks, TCP/IP, Higher Level Protocols, Important Components of the Web, Web Search Engines, Application Servers.

Unit – II 10 Hours

Introduction to XHTML, Cascading Style Sheets:
Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links. Lists, Tables, Forms, Frames.
Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

Unit – III 12Hours

The 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.
JavaScript and HTML Documents: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Event Model, The navigator Object Dom Tree Traversal and Modification,Pattern Matching using regular expressions, Errors in scripts, Examples.

Unit – IV 10 Hours

Dynamic Documents with JavaScript:
Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements,Cookies

Unit – V **10 Hours**

XML and WEB 2.0:
Introduction, Syntax, Document structure, XML displaying raw XML documents. Displaying XML documents with CSS, XSLT style sheets. What is Web 2.0? Folksonomies and Web 2.0, Software as a Service (SaaS), Data and Web 2.0, XML processors, Web services

Text Books	
1.	Robert W. Sebesta, Programming the World Wide Web, 4th Edition, Pearson education, 2008.
2.	Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
3.	M.Srinivasan: Web Programming Building Internet Applications, 3rdEdition, Wiley India, 2009.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Build** basic web concepts to build applications that are Object Based and Platform Independent.	L 3
2.	**Analyze** any given problem to get the desired output .	L 4
3.	**Apply** the concepts of JavaScript Technology in building web applications.	L 3
4.	**Develop** client side web applications.	L 6
5.	**Design** applications using XML.	L 6
6.	**Apply** the concepts of Web Technology in establishing his/her own entrepreneurship in the world of web programming.	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Video**	3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Digital Systems and Computer Organization (Theory)

Course Code	**18MCA13**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear ideaofthe basic structure and operation of a digital computer.
2. To explore different number system representation and conversion from one number system to another.
3. To impart the theorems and properties of Boolean algebra.
4. To explore the different ways of communicating with I/O devices and standard I/O interfaces.
5. To impart in detail the arithmetic operations and algorithms on fixed-point numbers and IEEE floating point representation.
6. To explore the working of hierarchical memory system including cache memories and virtual memory.
7. To emphasize performance of computer system and calculate the performance using SPEC rating.

Pre-requisites : --

Unit – I 10 Hours

Binary Systems, Combinational Logic

Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, Subtraction using r's and r-1 complements, Binary Code, Binary storage and Registers, Binary Logic, Integrated Circuits.

Boolean Algebra And Logic Gates

Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates.

Unit – II 08 Hours

Simplification Of Boolean Functions

The Map method, Two-and-Three variable maps, Four-variables Map, NAND and NOR Implementation, Other Two-Level Implementations, Don't Care Conditions. Introduction: Adders, Subtractors, Binary Parallel Adder, Decimal Adder.

Unit – III 10 Hours

Basic Structure of Computers

Computer types, Functional Units, Basic Operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer,

Machine Instructions and Programs

Memory Locations and Addresses, Memory Operations, Instructions and Instruction

Sequencing, Addressing Modes, Basic Input/Output operations

Unit – IV **12 Hours**

Input / Output Organization: Accessing I/O Devices, Interrupts, DMA Processor Examples, Buses.

Arithmetic : Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication

Unit – V **12 Hours**

The Memory System: Some Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Speed, Size, Cost, Cache Memories, Virtual Memories, Memory Management Requirements, Secondary Storage.

Text Books	
1.	M. Morris Mano , Michael D. Ciletti, Digital Design :With an Introduction to the Verilog HDL , 5th edition , Pearson
2.	Carl Hamacher, ZvonkoVranesicSafwatZaky, Computer Organization, 5th Edition, Tata McGraw-Hill, 2011
3.	John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, 3rdEdition,2012.
4.	Soumitrs Kumar Mandal, Digital Electronics- Principles and Applications, TataMcGraw-Hill, 2010.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Make use of** basic structure and operation of a digital computer, logical gates and **design** different circuits using logic gates.	L 3
2.	**Apply** the theorems and properties of Boolean algebra to simplify Boolean expressions, D**esign** logical circuits, **Demonstrate** the working of adders, subtractors in a computer system. [	L 6
3.	**Identify** different ways of communication with I/O devices and standard I/O interfaces and **Apply** arithmetic operations on binary number system.	L 3
4.	**Analyze** the performance of different computer systems by considering memory size, speed, architecture, and instruction set.	L 4
5.	**Discover** how programs and data are stored and represented in a computer system.	L 4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
5.	Post graduates can participate and succeed in competitive examinations.	**11**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Data Structures(Theory)

Course Code	**18MCA14**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide knowledge of data structures like stacks, queues, linked lists, and trees.
2. To impart benefits of dynamic and static data structure implementations.
3. To provide guidelines on selection of the appropriate data structure for modeling a given problem.

Pre-requisites:

- C Programming Language

Unit – I **12 Hours**

Introduction to functions, recursion and advanced concepts in C

Elements of user defined functions, defining functions, return values and their types, function calls, function declaration, category f functions – no arguments and no return values, arguments but no return values, arguments with return values, no arguments with return value, functions that return multiple values, recursion, passing arrays to functions, passing string to functions, programming examples.

Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members, array of structures, structures within structures, structures and functions, Unions

Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, pointer expressions, pointers and arrays, pointer and character strings, array of pointers, pointer as function arguments, functions returning pointers, pointers to functions, pointers and structures, programming examples,dynamic memory allocation, allocating a block of memory: malloc, allocating multiple blocks ofmemory: calloc, releasing the used space: Free, altering the size of ablock: realloc,

Unit – II **10 Hours**

Stack and Queues

Stack: Definition and examples. Primitive operation, Example, testing for exceptional conditions, implementing the push operation. Example: Infix, postfix and prefix, Basic definitions and examples. Evaluating a postfix expression, Program to evaluate a postfix expression, converting an expression from infix to postfix, Program to convert an expression from infix to postfix.

Queue: The queue and its sequential representation, C implementation of queues, Priority queue, Array implementation of a priority queue, circular queue and its implementation, de-queue (doubly ended queue) implementation

Unit – III **10 Hours**

Lists

Linked lists, Inserting and removing nodes from a list, Linked implementation of stacks, Linked implementation of queues, Linked list as a data structure, Example of list operation, Header nodes, Array implementation of lists, Limitations of array implementation, Allocating and freeing dynamic variables, Linked lists using dynamic variable, Other list structures, Circular lists, Stack as a circular list, Queue as circular list, Primitive operations on circular lists, doubly linked lists

Unit – IV **10 Hours**

Binary Trees

Binary trees, Operations on binary trees, Applications of binary trees. Binary tree representation, Node representation of binary tree, Internal and external nodes, implicit array representation of binary trees, choosing a binary tree representation, binary tree traversal using C, threaded binary trees. Representing list as binary tree: finding the K^{th} element, deleting an element, finding minimum and maximum element in a tree.

Unit – V **10 Hours**

Searching and Sorting

Searching: Sequential search, binary search, Binary Tree search, Exchange sort: Bubble sort, Quick sort. Selection sort and Tree sorting: Straight, selection sort, Binary tree sorts, sorting using a heap. Insertion sorts: Simple Insertion, Shell sort, Merge and Radix sorts. Tree Searching: Insertion into a Binary search tree, Deleting from a BST

Books

1. YedidyahLangsam, Moshe J.Augenstein and Aaron M. Tenanbaum, Data structures using C, PHI.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education Asia.
3. Anany Levitin, Introduction to design and analysis of algorithms, Pearson Education, 2003
4. Robert Kruse, C L Tondo, Bruce Leung and ShashiMogalla: Data Structures and Program Design in C, 2nd Edition, Pearson Education.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Recall** and **Apply** the basic concepts of C programming like functions, recursive functions, structures, unions and pointers.	L 3
2.	**Access**, **analyze** and **construct** various operations on stacks and queues.	L6
3.	**Create** linked data structures such as linked lists and binary trees.	L 6
4.	**Choose** appropriate searching and sorting technique in application development.	L 5
5.	**Design and develop** applications that require advanced data structures like BST, AVL trees etc., with both static and dynamic memory allocation.	L6

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
3.	Postgraduates will develop confidence for self-education and ability for life-long learning	**10**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Discrete Mathematical Structures (Theory)

Course Code	**18MCA15**	**Credits**	04
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**4-0-0**	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To providing a clear idea of Set and is fundamental requirement to study DMS.
2. To impart the art of applying language of logic.
3. To explore the concepts of Relations, Functions.
4. To identify the problems involving number theory, permutations and combinations.
5. To impart techniques of Mathematical Induction and Recurrence relations.
6. To explore Graph theoryessentials, usefulness and Matrix oriented topics.

Pre-requisites : --

Unit – I **12 Hours**

Fundamentals of Logic

Basic Connectives and Truth Tables, Logic Equivalence :The laws of Logic, Logical Implications: Rules of Inference, The use of Quantifiers, Quantifier Definitions, Proofs of Theorems

Unit – II **09 Hours**

Set Theory

Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Principles of Inclusion and Exclusion, The rules of sum and product, Permutations and Combinations with repetition

Unit – III **09 Hours**

Properties of Integers and Recurrence

Mathematical Induction, Recursive definitions, The Greatest Common Divisor Euclidian Algorithms, The first order Linear recurrence relation

Unit – IV **12 Hours**

Relations and Functions

Cartesian products and Relations, Functions-Plain and One-to-One, Onto Functions, Stirling Numbers and the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions. Properties of Relations, Computer recognition-Zero One Matrices and Directed graphs, Posets and Hasse Diagrams, Equivalence relation and Partitions, lattices.

Unit – V **10 Hours**

Graph Theory and Trees

Terminology, Definitions, Properties and Examples, Connectivity and Adjacency, Euler and Hamilton, Representation and Isomorphism, Planarity and Chromatic Number, Directed Graphs and Weighted Graphs, Rooted Trees, Trees and Sorting

Text Books	
1.	Kolman ,Busby,Ross"Discrete Mathematical Structures", 6th Edition Prentice Hall of India,2010.
2.	Jayant Ganguly: A Treatise on Discrete Mathematical Structures" Sanguine Technical Publishers, 2007.
3.	Ralph P Grimaldi, "Discrete & Combinatorial Mathematics, 5th Edition, Pearson Education, 2004
4.	Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Compile** the concepts of sets to practical situations. [L6]	L 6
2.	**Apply** the mathematical logic and construct logical arguments**. [L2]**	L 3
3.	**Distinguish** problems involving number theory, permutations and combinations. [L4]	L 4
4.	**Apply** concepts of Relations, Functions. [L3]	L 3
5.	**Apply** tools of Mathematical Induction and Recurrence relations	L3
6.	**Utilize** different concepts from Graph theory.	L3

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**

Course delivery methods		Assessment methods	
1.	**Lecture**	1.	**Internal Assessment Test**
2.	**Power-Point Presentation**	2.	**Quiz**
3.	**Video**	3.	**Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Unix and Shell Programming Laboratory

Course Code	**18MCA16**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide core aspects of Unix operating system, focusing on editors, command usage, filters, regular expressions and other utility tools.
2. To explore the fundamentals of Unix command set and their usage to provide sufficient knowledge on writing scripts with different Unix languages.

Pre-requisites :

- Unix and shell Programming (18MCA11)

Laboratory Exercises:

Minimum 08 experiments can be framed on the following concepts:

1. General purpose utilities
2. File handling commands
3. Basic file attribute commands
4. Simple filters and Regular expressions
5. grep command
6. sed command
7. awk command

Text Books	
1.	M.G.Venkateshmurthy, Introduction to UNIX & SHELL Programming, Pearson publication 2006
2.	Sumitabha Das, Your UNIX-The Ultimate Guide, Tata McGraw Hill 2001
3.	ForouzanGilberg, "UNIX and Shell Programming", Cengage Learning 2003.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Experiment with** basic utilities of Unix.	L 3
2.	**Classify** the file types with different file attributes.	L 4
3.	**Utilize** file handling techniques.	L 3
4.	**Appraise** vi editor and demonstrate different modes and features.	L 5
5.	**Make Use of** pipes and filters like grep, sed.	L 3
6.	**Develop** basic and extended regular expressions to demonstrate pattern matching techniques.	L 6
7.	**Design** Shell programs for solving various problems using essential and advanced features of shell programming.	L 6

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**

Program Specific Outcomes (PSOs)

1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
2.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Web Programming Laboratory

Course Code	**18MCA17**	**Credits**	01
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	50 marks
Total Hours:	**28**	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide knowledge of Web Technologies to build a Web Application.
2. To impart designing and developing front-end and back-end of a Web Application.
3. To explore the advantages of emerging Web Technologies and the environment in which they are used.

Prerequisites: --

Minimum 8 experiments can be framed on the following Concepts:

1. Basic text formatting tags
2. Fonts
3. Tables
4. External hyperlinks and Internal hyperlinks
5. Image insertion,
6. Cascading Style Sheets(CSS),
7. Forms
8. JavaScript Arrays
9. JavaScript strings
10. String Manipulations
11. JavaScript operators
12. Event handling
13. Extensible Markup Language(XML),
14. Document Type Definitions (DTD's)
15. XSLT style sheet.

Text Books	
1.	Robert W. Sebesta, Programming the World Wide Web, 4th Edition, Pearson education, 2008.
2.	Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Develop** web pages that adhere to the standards of W3C recommendation.	L 6
2.	**Categorize** the various navigation strategies.	L 4
3.	**Design** Web pages using Client-Side technologies like XHTML CSS forms, and JavaScript.	L 6
4.	**Develop** Web documents that are usable and accessible using Web Authoring.	L 6
5.	**Identify** and **evaluate** Website organizational structure.	L5
6.	**Develop** an XML application.	L 6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**

Program Specific Outcomes (PSOs)

1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hoursduration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Data Structures Laboratory(Lab)

Course Code	**18MCA18**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To impart programming strategy using Top-Down approach to solve complicated problems.
2. To deliver knowledge on principles of programming languages, programming methodologies, design and analysis of algorithms using data structures.
3. To explore skills to write algorithms for implementing stacks, queues, linked lists, trees, and graphs.
4. To impart knowledge on hashing techniques, searching techniques and sorting techniques.
5. To explore recursive algorithms in implementing trees and graphs
6. To familiarize the issues of time complexity and examine various algorithms.

Pre-requisites :

- Data Structures (18MCA14)

Minimum 08 experiments can be framed on the following concepts:

1. Recursion
2. Stack
3. Queues
4. Linked lists
5. Trees
6. Searching and Sorting techniques

Text Books	
1.	Aaron M. Tenenbaum, YedidyahLangsam and Moche J. Augenstein- Data Structures using C and C ++, , 2006, Pearson Education/ PHI
2.	E. Balagurusamy- Programming in ANSI C, edition 4, Tata McGrawHill
3.	Behrouz A. Foruzan and Rechard F. Gilberg- Computer Science A Structured Programming Approach Using C, Second edition, 2003, Thomson
4.	Robert Kruse and Bruce Leung- Data structures and Program Design in C, 2007, Pearson Education
5.	D. Samantha- Classic Data Structures, 2001, Estern Economy edition, PHI

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Construc**t and **analyze** different sorting algorithms like Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Shell sort and Heap sort	L 6
2.	**Appraise** and **Design** the Abstract Data Type (ADT) using both array based and linked-list based data structures, including single, double and circular linked-lists and its applications	L 6
3.	**Appraise** and **Design** the Stack ADT using both array based and linked-list based data structures and also implement Stack applications	L 6

4.	**Appraise** and **Design** the Queue ADT and Circular Queue ADT using both array based and linked-list based Data structures	L 6
5.	**Appraise** and **Design** binary tree ADT using linked list based data structures, AVL tree operations and implement graph traversal techniques	L 6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**

1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
2.	**PSO3: Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours/ 2 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

II Semester
Programming using Java

Course Code	**18MCA21**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce an overview of Java Language and its basic programming concepts.
2. To impart the knowledge of various OOPS concepts and its implementation in Java.
3. To introduce the implementation of Packages, Interfaces and usage of exception handling.
4. To provide emphasis on the strengths of Java Language like Multithreaded Programming and Networking.
5. To introduce the strengths of Java language like Applets, Event Handling and Swing controls

Pre-requisites: --

Unit – I **10 Hours**

The Java Language: The Java Buzz words. **An Overview of Java:** Object Oriented Programming, The Three OOP Principles, A first simple program, Two control statements, Using blocks of code, Lexical Issues. **Data types, Variables and Arrays:** The primitive types, variables, type conversion and casting, Arrays. **Control statements, String Fundamentals. Introducing Classes:** class fundamentals, declaring objects, introducing methods, constructors, The this keyword, Garbage collection, The finalise() method, A stack class. **A closer look at methods and classes:** Overloading methods, Using objects as parameters, Argument passing, returning objects, Recursion, Introducing access control, Understanding static, Introducing final, Nested & Inner classes, Command line arguments, varargs.

Unit – II **10 Hours**

Inheritance: Basics of inheritance, using super, Multilevel hierarchy, when constructors are executed, Method Overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, The Object class. **Packages:** Packages, Access protection, Importing Packages. **Interfaces:** Interfaces, Default Interface Methods, Use static methods in an Interface.

Unit – III **11 Hours**

Exception Handling: Exception Handling Fundamentals, Exception types, uncaught exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's built-in Exceptions, Creating your own Exception Sub classes, Chained Exceptions. **Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities,

Synchronization, Inter thread communication, suspending, resuming & stopping Threads, Obtaining a Thread's state, Using Multithreading.

10 Hours

Unit – IV

Networking with Java.net: Networking Basics, The Networking Classes and Interfaces, InetAddress, TCP/IP Client Sockets, URL, URLConnection, HttpURLConnection, the URI Class, Cookies, TCP/IP Server Sockets, Datagrams. **Applets:** The Applet Class, Two types of Applets, Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display methods, Requesting Repainting, Using the status window, The HTML APPLET Tag, Passing parameters to Applets, get DocumentBase(), get CodeBase(), Applet Context &showDocument, The Audioclip Interface, The AppletStuc Interface, Outputting to the console.

Unit – V **11 Hours**

Event Handling: Two Event handling mechanisms, The delegation Event Model, Event Classes, The KeyEvent Class, sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes. **Introducing GUI Programming with Swing: Introducing Swing**- Two Key Swing features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Create a Swing Applet, Painting in Swings. **Exploring Swing**-JLabel, ImageIcon, JTextField, The Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox, JTable, **Introducing Swing Menus**- Menu Basics, An Overview of JMenuBar, JMenu, JMenuItem, Create a Main Menu, Add Mnemonics & Accelerators to Menu Items, Add Images & Tool tips to Menu Items, use JRadioButtonMenuItem and JCheckBoxMenuItem, Create a Popup Menu, Creating a Toolbar, Use Actions.

Text Books	
1.	Java, The Complete Reference, Seventh Edition, Herbert Schildt. Tata McGraw-Hill 2006.
2.	Java Fundamentals-A Comprehensive Introduction, Edition 2013, Herbert Schildt, Dale Skrien, Tata McGraw-Hill
3.	T V Suresh Kumar, B Eshwara Reddy and P Raghavan, Programming with Java, Sanguine Technical Publishers, 2011

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Experiment With** the basic concepts Java programming language	L 3
2.	**Utilize** the key features of Object Oriented Programming	L 3
3.	**Apply** the concepts of interfaces and exceptions handling mechanisms in software development using Java technology	L 3
4.	**Utilize** the features of packages and generics in Java programming	L 3
5.	**Make use** of Applet/JApplet to design internet based applications and DesignGUI for desktop based applications using swings.	L 3

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	3
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	5
3.	Postgraduates can participate and succeed in competitive examinations	11

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Database Management System (Theory)

Course Code	**18MCA22**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear knowledge of the nature of Database Management System including their structure, design, and evaluation
2. To correlate the relationship between DBMS and information systems used in libraries and business
3. To impart knowledge on designing Entity-Relationship (ER) diagram.
4. To analyze the process of normalization in relational databases.
5. To provide knowledge on writing Structured Query Language (SQL) and its standards in the current and future development of DBMS.

Pre-requisites: --

Unit – I 10 Hours

Introduction: Introduction, An example, Characteristics of Database approach, Actors on the screen, Workers behind the scene, Advantages of using DBMS approach, A brief history of database applications, when not to use a DBMS. Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, The database system environment, Centralized and client-server architectures, Classification of Database Management systems.

Unit – II 10 Hours

Entity-Relationship Model and Relational Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams.
Relational Database Design Using ER- to-Relational Mapping ,Naming Conventions and Design Issues, Relationship types of degree higher than two. Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and dealing with constraint violations

Unit – III 10 Hours

SQL: SQL Data Definition and Data Types, Specifying basic constraints in SQL, Schema change statements in SQL, Basic queries in SQL, JOINs and types of JOINs, More complex SQL Queries. Insert, Delete and Update statements in SQL, Views (Virtual Tables) in SQL**.**

11 Hours

Unit – IV

Database Design and PL/SQL: 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.

Introduction to PL/SQL, Language fundamentals, conditional and sequential control, Iterative processing and loops. Exception handlers, triggers. Functions, stored procedures. Creating and planning PL/SQL

Unit – V **11 Hours**

Indexes and Cursors: Creating indexes, changing an index, recreating an index, obtaining information about indexes, eliminating an index. Creating cursors, accessing cursor rows, attributes of cursors (explicit and implicit).

Implement a program using cursors to update the salary of employees.

Implement a program using triggers to creates a row-level trigger for the customers table that would fire for insert or update or delete operations performed on the customers table.

Text Books	
1.	Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison - Wesley, 2011.
2.	Jose A Ramalho, Learn Oracle 8i, BPB publications.
3.	C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8 th Edition, Pearson education,2009.
4.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3 rd Edition, McGraw-Hill, 2003.
5.	Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Discuss** the fundamental concepts and features of DBMS	L 6
2.	**Demonstrate** the use of Data Models.	L 3
3.	**Interpret** and use SQL to solve queries.	L 3
4.	**Design** database using normalization techniques.	L 6
5.	**Build** PL/SQL applications with appropriate demonstration using triggers, stored procedures, cursors and indexes	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications and management.	**1**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Operating Systems (Theory)

Course Code	18MCA23	**Credits**	04
Course type	CC	**CIE Marks**	50 Marks
Hours/week:	4-0-0	**SEE Marks**	50 Marks
Total Hours	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 Marks

Course learning objectives

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of Operating System to handle processes and threads, their communication.
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To learn the mechanisms involved in memory management in contemporary Operating System.
5. To learn the concepts of file management in Operating System.

Pre-requisite:

- Digital Systems and Computer Organization (18MCA13)

Unit – I 10 Hours

Introduction to Operating Systems, System structures : Introduction and features of operating systems; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments.

System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

Unit – II 10 Hours

Threads and Process Management: Overview; Multithreading models; Thread Libraries; threadingissues.Process Concept, Process Control Block (PCB) Process State, Process Scheduling long, medium and short term schedulers, scheduling criteria; Scheduling algorithms FCFS, SJF, Priority Scheduling, Round Robin, Multiple-Processor scheduling; Thread scheduling.

Unit – III 10 Hours

Deadlocks and Concurrency Control: Deadlocks; Deadlock characterization; Methodsfor handling deadlocks; Deadlock prevention; Deadlock avoidance, banker's Algorithm; Deadlock detection and recovery from deadlock.

Synchronization: The Critical section problem; Synchronization hardware; Semaphores;Classical problems of synchronization: Reader Writers Problem, Producer Consumer Problem

Unit – IV **10 Hours**

Memory Management: Memory Management Strategies: Swapping; Contiguous memory allocation; paging; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement algorithms FIFO,LRU and OPR; Allocation of frames; Thrashing

Unit – V **12 Hours**

File System, Implementation, File concept; Access methods; Directory structure: Single Level, Two Level, Tree-Structured Directories, Acyclic-Graph Directory, General graph directory; File system mounting; Protection. Implementing File System: File system structure; Directory implementation, Allocation Methods Disk Scheduling Methods.

Demonstration: Installation of Windows / Linux Operating SystemCreating new groups and users in Windows, Linux Operating System. Linux File System.

Text Books	
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 7th edition, Wiley India, 2006.
2.	D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw-Hill, 2002

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Illustrate** structures and history of operating systems.	L 3
2.	**Analyze** issues associated with operating systems.	L 3
3.	**Solve** process management concepts including scheduling, synchronization, deadlocks	L 3
4.	**List** the features and limitations of an operating system used to provide protection.	L 4
5.	**List** out the features of directory system	L 4

Sl. no	**Program Outcome of this course (POs**	**PO No.**
1	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**

Course delivery methods	Assessment methods
1. Lecture	**1. Internal Assessment Test**
2. Power-Point Presentation	**2. Quiz**
3. Video	**3. Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Computing for Data Analytics (Theory)

Course Code	**18MCA24**	**Credits**	3
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To explore handling numeric data
2. To appreciate the role of statistics as business decision making tool.
3. To enable student to learn the statistical tests / procedure often used by data practitioners.
4. To give a insight into the predictive analysis techniques like correlation & regression
5. To explore the statistical tools like Excel, SPSS used for data analytics.

Pre-requisites:

- Discrete Mathematics (18MCA15)

Unit – I 09 Hours

Introduction: What is statistics? Functions of statistics, Statistical methods, Characteristics of statistical data, Some other definition of statistics, Origin of statistics.

Statistical Enquiries and Sampling : Introduction, Population, Census Enumeration, Sampling, Law of Statistical Regularity, Law of Large Numbers, Census vs Sample Enumeration, Random Sampling, Non Random Sampling

Classification and Tabulation: Introduction, Classification, Organizing Quantitative data, Selecting Class intervals, Two way frequency distribution, cumulative frequencies, Statistical series, Statistical tables, Types of tables.

Unit – II 09 Hours

Descriptive Statistics and Measures of central Tendency and Dispersion: Descriptivestatistics , measures of central Tendency, The Arithmetic Mean, Arithmetic Mean of grouped data, Properties of the Mean, Short cut method for calculating mean, The Weighted Arithmetic Mean, The Median, Location of Median by graphical Analysis, Quartiles, Deciles and Percentiles, The Mode

Measures of dispersion: Introduction, Measures of Dispersion, The Range, Quartile Deviation, Mean Deviation, Coefficient of Mean Deviation, Standard Deviation.

Calculating Standard Deviation by Short cut method

Unit – III 09 Hours

Correlation: Introduction, Methods of Studying Correlation, Scatter diagram method, Karl Pearson's Coefficient of Correlation, Probable Error, Correlation in Bivariate Frequency table, Rank Correlation Method.

Linear Regression Analysis: Introduction, Linear and non linear regression, Lines of regression, Coefficients of regression. Correlation Analysis Vs Regression Analysis

Unit – IV **09 Hours**

Probability : Introduction, Probability, A Priori Probability, Mathematics of probability, Addition Rule of Probability, Conditional Probabilities, The Multiplication Rule, Bayes Theorem on inverse probability, Permutations and Combinations, Applications of probability, Mathematical Expectations.

Unit – V **09 Hours**

Random Variables and Probability Distributions: Random variable, Probability distribution of a discrete random variable, Probability distribution of a continuous variable, Distributive Function or Cumulative probability function, Mathematical Expectation, Joint and Marginal probability distributions, Binomial Distribution, Poisson Distribution, Normal Distribution.

Text Books	
1.	C B Gupta and Vijay Gupta : An Introduction to Statistical Methods, 23rd Edition, Vikas Publishing House Pvt Ltd, 2008
2.	S C Gupta : Fundamentals of Statistics, 6th Revised and Enlarged Edition, Himalaya Publishing House,2009
3.	R H Dhareshwar and SangeetaShetti, Business Statistics - II, R Chand & CO Publishers, 1st Edition, 2018
4.	Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, 3rd Edition, Elsevier Academic Press

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify and Apply the use of different measures of average for sample population	L3
2.	Apply probability theorems using Bay's rule	L3
3.	Identify the type of random variables, Calculate the variance and co-variance of random variable.	L3
4.	Build simple regression model of data variables for prediction.	L4
5.	Make use of statistical concepts in data and business analytics	L3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications and management.	**1**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
6.	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.	**12**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Software Engineering

Course Code	**18MCA25**	**Credits**	03
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide an idea of Software Engineering, Software Product Development Phases and its applications in real world.
2. To impart recent trends in Software Engineering like extreme programming and evolutionary methods, Use of Component Based Software Engineering.
3. To apply analytical skills to justify planning methodology for software development.
4. To extract information regarding software development, planning, modeling, implementation and testing a software product
5. To explore testing techniques, viz. black box and white box testing, testing tools and methodology and analyze modeling techniques.

Pre-requisites: --

Unit – I 09 Hours

Introduction to Software Engineering and Software Processes

Introduction to Software Engineering: Professional Software Development Attributes of good software, software engineering diversity, Software engineering and the web, software engineer's ethics.

Software Process Models: waterfall, incremental development, reuses oriented Process activities, Coping with change, The Rational Unified process. Agile methods, Plan-driven and Agile Development, Extreme Programming

Unit – II 09 Hours

Software Requirements Engineering and System Modeling

Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirement elicitation and analysis, Requirements validation, Requirements management.

System Modeling: Context models, Interaction models, Structural models, Behavioral models.

Unit – III 09 Hours

Software Architecture, CBSE and Distributed systems

Architecture design decisions, architectural views, architecture patterns Components and component model, Components and component model, CBSE process, Component composition ,Distributed system issues, Client-server computing, Architectural patterns for distributed systems.

Unit – IV **09 Hours**

Principles of Testing and Testing methodology - 1

Basics of software testing, Software quality, requirement behavior and correctness, Test cases, Insights from a Venn diagram, Identifying test cases, Error and Fault taxonomies, Levels of testing. Basic types of testing (Black-Box, White –Box testing).

Testing Methodology: Boundary value analysis , Equivalence class value tests.

Unit – V **09 Hours**

Testing methodology – 2 and Case Studies

Testing methodology: Decision Table Testing, path testing, Data flow Testing

Case studies Like:

- Prepare requirement document for feedback management system. Use suitable models to design the system. Implement any module/sub-module in any programming language. Generate test cases for the same.(Any testing method may be used)
- Prepare requirement document for Super market. Use suitable models to design the system. Implement any module/sub-module in any programming language. Generate test cases for the same. (Any testing method may be used)
- Design and Develop code and run the program in suitable language to implement the **Merge Sort**. Derive different test cases, execute these test cases and discuss the results

Text Books	
1.	Ian Sommerville: Software Engineering, 9th edition, Person Education Ltd, 2011
2.	Paul C Jorgensen: Software Tesing, A Craftman's Approach,4th edition, CRC Press Tiylor and Frances Group
3.	Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify** different Software Engineering models: Eg. Waterfall, Incremental Development, Reuses Oriented, Process Activities; Coping with change, and The rational Unified Process	L3
2. **Analyze** the Functional and Non-functional requirements and Software Requirement Specification.	L4
3. **Interpret** software architecture and **analyze** architectural views	L4
4. **Utilize** different Testing Techniques like: Boundary value analysis, Equivalence class value, and Decision Table Testing and Equivalence class value tests.	L3
5. **Develop** solutions for various real life problems using the knowledge of Software Engineering methodology, and generate test cases for the same.	L6

Program Outcome of this course (POs)	PO No.
1. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	4
2. Postgraduates will demonstrate knowledge of professional and ethical responsibilities	7
3. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional	9

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Java Programming Laboratory

Course Code	**18MCA26**	**Credits**	1
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To impart the practical implementation of fundamental OOPS concepts.
2. To impart the knowledge of usage of interfaces.
3. To illustrate mechanism of exception handling in Java.
4. To provide emphasis on the strengths of Java like packages, Multithreaded Programming.
5. To explore with the strengths of Java like Networking, Applets and Swing controls.

Pre-requisites :

- Programming Using Java (18MCA21)

Laboratory Exercises

Maximum 8 experiments can be framed based on the following Java concepts

1. Method overriding
2. Dynamic method dispatch
3. Interfaces
4. Exception handling mechanism
5. Packages
6. Multithreaded Programming
7. Interthread communication
8. Applets
9. Swings
10. Networking
11. String Handling

Text Books	
1.	Java, The Complete Reference, Seventh Edition, Herbert Schildt. Tata McGraw-Hill 2006.

2.	T V Suresh Kumar, B Eshwara Reddy and P Raghavan, Programming with Java, Sanguine Technical Publishers, 2011

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Apply** the basic concepts of Java programming language such as Dynamic method dispatch.	L 3
2. **Make use of** interfaces and custom exception handling mechanisms in software development using Java technology	L 3
3. **Experiment with** string handling functions	L 3
4. **Utilize** the features of packages and multithreading in Java programming	L 3
5. **Construct** internet based applications using Applet/JApplet and Build GUI for desktop based applications using swings.	L 3

Program Outcome of this course (POs)	PO No.
1. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	3
2. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	4
3. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	5

Program Specific Outcomes (PSOs)	
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
2.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Database Management Systems Laboratory

Course Code	**18MCA27**	**Credits**	1
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide a clear understanding of Database Management System as a subject in its own right
2. To familiarize the participant with the nuances of database environments towards an information- oriented data processing oriented framework
3. To give a good formal foundation on the relational model of data and also to present SQL and procedural interfaces to SQL comprehensively
4. To introduce systematic database design approaches covering conceptual design

Pre-requisites: --

Laboratory Exercises:

Minimum 8 experiments in Part-A can be framed on the following concepts.

1. Integrity rules and simple queries
2. Nested queries
3. Types of joins
4. Views
5. Aggregate functions
6. Triggers
7. Stored procedures and functions
8. Cursors and indexes.

Books	
1.	Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
2.	Jose A Ramalho, Learn oracle 8i, BPB publications.
3.	Silberschatz, Korth and Sudharshan: Data base System Concepts,5th Edition, Mc-GrawHill, 2006
4.	C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education 2006
5.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Design** a Database and **explain** the characteristics and functions of Database Management System along with types of Database Users.	L 6
2.	**Contrast** Data Models, Schemas, Instances, Three Schema Architecture and DBMS Component Modules.	L 6
3	**Design** Entity-Relationship (ER) modeling.	L6
4	**Design** queries in SQL.	L6
5	**Analyze** the Functional Dependencies and Inference Rules.	L4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**

Program Specific Outcomes (PSOs)	
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Software Engineering and Testing Lab

Subject Code:	**18MCA28**	**Credits:**	**1**
Course Type:	**CC**	**CIE Marks:**	**50**
Hrs/Week: L:T:P	**0-0-1**	**SEE Marks:**	**50**
Total Hours:	**28**	**SEE Duration:**	**3 Hrs.**

Course Learning Objectives

1. To provide a clear understanding of Software development process.
2. To introduce the basic design techniques
3. To impart basic testing methodology.

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Prerequisites:

- Software engineering (18MCA25)

Laboratory Exercises:

PART-A

Software Engineering Lab:

- Visit a barn (cow-shed)/ Grocery shop/ whole- sale vegetable seller located nearby. Gather all the requirements for automation of the system. Design appropriate solution.
- A college needs to automate transportation management system. Gather all the requirements for automation of the system. Design appropriate solution.

PART-B

Minimum 6 Experiments on concepts of software test like

1. Decision-table approach
2. Boundary-value analysis
3. Basis paths
4. Equivalence class value testing.

Books	
1.	Ian Somerville: Software Engineering, 9th edition, Person Education Ltd, 2011.
2.	Paul C Jorgensen: Software Tesing, A Craftman's Approach,4th edition, CRC Press Tiylor and Frances Group.

Course Outcomes (COs)

1.	**Analyze** functional and non- functional requirements	L4
2.	**Design** solutions for various problems	L6
3.	**Identify** and **utilize** Software Engineering models	L3
4.	**Identify** and implement design techniques	L3
5.	Utilize testing techniques	L3

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates will demonstrate skills to use modernsoftware tools and technology to build and test applications.	**6**

	Program Specific Outcomes (PSOs)
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity. [PSO1]
2.	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies. [PSO3]

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

ESTD. 1939

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"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
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ESTD. 1979

2018-19 Scheme

Department: MCA

Programme: MCA

1rd to 6th Semester Scheme of Teaching and Examination

3rd and 4th Semester Syllabus

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become quality engineers with high standards of professionalism and Ethics who have positive attitude, a perfect blend of techno-managerial skills and problem solving ability with an analytical and innovative mindset.

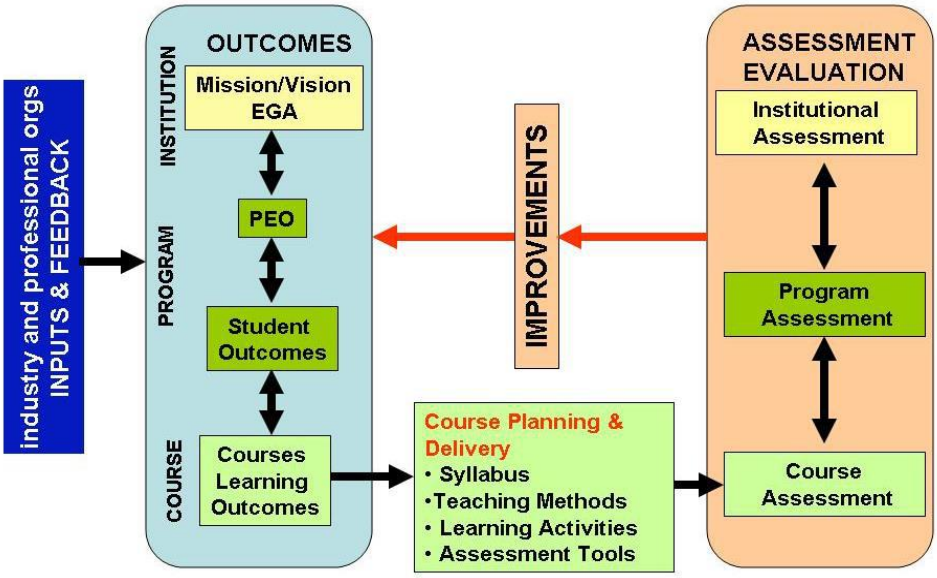
QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
The department of Master of Computer Applications shall strive to stand out as par excellence in generating and grooming, technically competent and skilled intellectual professionals to meet the challenges of the modern computing industry.

MISSION
To train the graduates to become IT professionals having strong fundamental knowledge in the field of computer application with ethical values to meet increasing global challenges of ever evolving technologies.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs) :

1. Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.
2. Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.
6. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.
7. Postgraduates will demonstrate knowledge of professional and ethical responsibilities.
8. Postgraduates will be able to communicate effectively in both verbal and written form.
9. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional.
10. Postgraduates will develop confidence for self-education and ability for life-long learning.
11. Postgraduates can participate and succeed in competitive examinations.
12. Postgraduates will use research-based knowledge and research methods including design of experiments,analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Real Life Problem Solving: Postgraduates of the programme will develop solutions to the real world problems by developing computer applications using the knowledge of mathematics, computer science and engineering in the diverse field of Information Technology.

PEO2: High-Quality Computer Professionals: The postgraduates shall practice and grow as computer professionals by conducting research, design, develop, test and maintain projects in varied fields of computer science and engineering using the state-of-the-art tools and technologies.

PEO3: Leadership Skills: The postgraduates will exhibit their leadership skills with ethics, integrity, competency and social responsibility.

PEO4: Lifelong Learning: The postgraduates shall always stand out of the crowd by enhancing their abilities in their profession through lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **PSO1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

2. **PSO2: Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality application for business success.

3. **PSO3: Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

PROGRAM SPECIFIC CRITERIA (PSCs):

PSC 1: Apply the knowledge of mathematics, computing and management through critical thinking in addressing the real time problems.

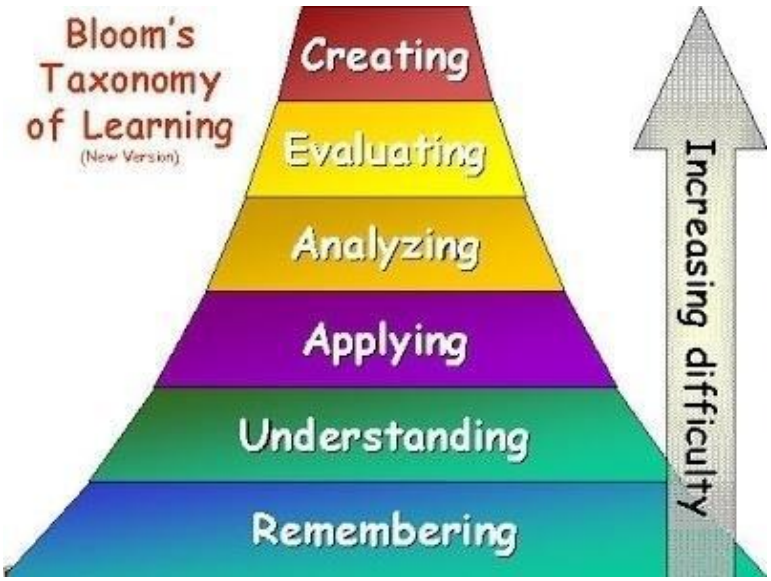
PSC 2: To design, analyze, model and realize physical systems, components or processes using modern software tools and technologies.

PSC 3: Prepare students to work professionally in multidisciplinary environments.

BLOOM'STAXONOMYOFLEARNINGOBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills(LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills(HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination -1st to 6thSemesterMCA

As per the guidelines of UGC CBCS the courses can be classified into:

(i) Core Courses (PC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

(ii) Foundation Courses: The Foundation Courses are of two kinds:

Compulsory Foundation: These courses are the courses based upon the content that leads to Knowledge enhancement.These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

(iv) Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining MCA Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for MCA program

Total credits for MCA Program: credits

		Regular batch		Lateral entry	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	23	44	--	--
	2	21		--	
2nd year	3	22	44	22	44
	4	22		22	
3rd year	5	21	44	21	44
	6	23		23	
	Total	**132**	**132**	**88**	**88**

Credit definition:

Lecture (L):One Hour /week – 1 credit

Tutorial (T): Two hour /week – 1 credit

Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination -1st to 6th Semester MCA

I Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA11	Unix and Shell Programming	CF	4-0-0	4	4	50	50	100
2	18MCA12	Web Programming	CF	4-0-0	4	4	50	50	100
3	18MCA13	Digital Systems and Computer Organization	CC	4-0-0	4	4	50	50	100
4	18MCA14	Data Structures	CC	4-0-0	4	4	50	50	100
5	18MCA15	Discrete Mathematical Structures	CC	4-0-0	4	4	50	50	100
6	18MCA16	Unix & Shell Programming Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA17	Web Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA18	Data Structures Laboratory	CC	0-0-2	2	1	50	50	100
			Total	**20-0-6**	**26**	**23**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:**Compulsory Foundation

II Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA21	Programming using Java	CC	4-0-0	4	4	50	50	100
2	18MCA22	Database Management Systems	CF	4-0-0	4	4	50	50	100
3	18MCA23	Operating Systems	CC	4-0-0	4	4	50	50	100
4	18MCA24	Computing for Data Analytics	CC	3-0-0	3	3	50	50	100
5	18MCA25	Software Engineering	CC	3-0-0	3	3	50	50	100
6	18MCA26	Java ProgrammingLaboratory	CC	0-0-2	2	1	50	50	100
7	18MCA27	Database Management Systems Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA28	Software Engineering & Testing Lab	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:**Compulsory Foundation

III Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours /Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA31	Computer Networks	CF	4-0-0	4	4	50	50	100
2	18MCA32	Python Programming	CC	4-0-0	4	4	50	50	100
3	18MCA33	Cloud Computing	CC	4-0-0	4	4	50	50	100
4	18MCA34	Introduction to server-side programming using PHP	CC	4-0-0	4	4	50	50	100
5	18MCA35X	Elective – 1	FE	3-0-0	3	3	50	50	100
6	18MCA36	Computer Networks Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA37	Python Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA38	PHP Programming Laboratory	CC	0-0-2	2	1	50	50	100
			Total	**19-0-6**	**25**	**22**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective

Certification Courses: 2-credits

- Two certifications are compulsory and need to be completed before start of 6th semester.
- Choose certifications, which have industrial acceptance.
- Students have to submit the certificates with valid score of the certifications they have completed to the department during 6th semester. **This is mandatory for the award of the credits and degree.**
- These certifications are evaluated by a panel formed at college level during 6th semester for the award of 2 credits.

Elective Group

Note: Students are advised to select any one subject from the following elective group for Elective-1

Elective Group-1

Sl. No.	Course Code	Course Title
1	351	System Software
2	352	Linux Administration
3	353	Enterprise Resource Planning
4	354	Object Oriented Modeling and Design patterns

IV Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA41	Analysis and Design of Algorithms	CC	4-0-0	4	4	50	50	100
2	18MCA42	Programming Using J2EE	CC	4-0-0	4	4	50	50	100
3	18MCA43	Introduction to Big Data paradigm	CC	4-0-0	4	4	50	50	100
4	18MCA44X	Elective – 2	GE	3-0-0	3	3	50	50	100
5	18MCA45X	Elective – 3	GE	3-0-0	3	3	50	50	100
6	18MCA46	Algorithms Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA47	J2EE Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA48	Big Data Laboratory	CC	0-0-2	2	1	50	50	100
9	18MCA49	Communicative English	CF	1-0-0	2	1	50	--	50
			Total	**19-0-6**	**25**	**22**	**450**	**400**	**850**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective**GE:** Generic Elective.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-2 and Elective-3 respectively.

Elective Group-2

Sl. No.	Course Code	Course Title
1	441	Advanced Database Management System
2	442	Internet Of Things
3	443	Software Project Management
4	444	Soft Computing

Elective Group-3

Sl. No.	Course Code	Course Title
1	451	Information Storage Network
2	452	Application Development using MVC Frameworks
3	453	Client-Server Computing
4	454	Digital Marketing

V Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/ Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA51	Mobile Application Development	CC	4-0-0	4	4	50	50	100
2	18MCA52	.NET Programming using C#	CC	4-0-0	4	4	50	50	100
3	18MCA53	Machine Learning	CC	4-0-0	4	4	50	50	100
4	18MCA54X	Elective – 4	GE	3-0-0	3	3	50	50	100
5	18MCA55X	Elective – 5	GE	3-0-0	3	3	50	50	100
6	18MCA56	Mobile Application Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA57	C# Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA58	Project Work-1	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **GE:** Generic Elective

Recommended to publish paper of Mini project work in any reputed journals like IEEE/ Springer/Elsevier (Science Direct)/Scopus/DBLP indexed conference etc.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-4 and Elective-5 respectively.

Elective Group- 4

Sl. No.	Course Code	Course Title
1	541	Advance Computer Networks
2	542	Cyber security and cyber Laws
3	543	Virtual Reality
4	544	Services Oriented Architecture

Elective Group- 5

Sl. No.	Course Code	Course Title
1	551	Web 2.0 and Rich Internet Applications
2	552	Information Retrieval
3	553	NoSQL
4	554	Wireless and Mobile Computing

VI Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks		Total Marks
								Demonstration, Presentation and Viva	Dissertation	
1	18MCA61	Internship	CC	NA	Full Time	4	50	--	--	50
2	18MCA62	Project Work-2	CC	NA	Full Time	15	50	100	50	200
3	18MCA63	Seminar	SC	NA	2	2	50	-	-	50
4	18MCA64	Certification-1 (Cambridge/ Technical Certification)	CC	NA	1	1	--	--	--	--
5	18MCA65	Certification-2 (Technical Certification)	CC	NA	1	1	--	--	--	--
Total				NA	--	23	150	100	50	300

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Compulsory Core **SC:** Seminar Component **NA:** Not Applicable

18MCA64 and 18MCA65: Certification Courses

*****

3rd and 4th Semester Syllabus

Computer Networks (Theory)

Course Code	**18MCA31**	**Credits**	04
Course type	CF	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To give an insight into computer networks, various networking devices and its applications in fast evolving technological world.
2. To expose the real-world applications using computer networks.
3. To explore different types of networks.
4. To impart the different layers in TCP/IP and OSI reference model with their functionalities and services.
5. To explore different data transmission modes along with error detection and correction methods.
6. To impart routing and congestion control concepts in data transmission.

Pre-requisites :

- Digital systems and computer organization (18MCA13)
- Data Structures (18MCA14).

Unit - I — 12 Hours

Introduction to computer networks and Physical Layer

Uses of Computer Networks, Network Hardware, Network software, Classification of Computer Networks, Reference Models, Network Protocol Stack (TCP/IP and ISO-OSI).

Physical Layer: Theoretical Basis for Data Communication, Data Transmission Concepts, Analog and Digital Data Transmission, Guided Transmission Media, Wireless Transmission, Digital Modulation and Multiplexing.

Unit - II — 10 Hours

Data Link Layer and Medium Access Control Layer

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, Ethernet, Wireless LANs, Data Link Layer Switching.

Unit - III — 10 Hours

Network Layer

Network layer design issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, The network layer in the internet.

10 Hours

Unit – IV

Transport Layer

The transport services, Elements of Transport Protocols, congestion control, The Internet Transport Protocols: TCP, UDP.

Application Layer

DNS-Domain Name System, Email, WWW, Introduction to Streaming Audio and Video and content delivery.

Unit – V

10 Hours

Case studies

Network Standardization: Telecommunication, Internet standards, Problems on data transmission, Network Simulator: Over view of NS-2, The Mobile Telephone System: Comparison of circuit-switched and packet-switched networks, Study of 1G (Analog voice), 2G (Digital Voice), 3G Mobile phones (Digital voice with data), Wireless Technologies: Bluetooth, RFID, Network Layer in the Internet: Issues related to internetworking, Comparison study of IPv4 and IPv6 IP addresses and related problems, UDP & TCP Performance Issues in computer networks, Real-Time conferencing protocols: H.323(Internet Telephony) and SIP.

	Text Books:
1.	Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5th edition, Pearson Education.
2.	Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
3.	William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
4.	Mahbub Hassan and Raj Jain , High Performance TCP/IP: Networking Concepts, Issues, and Solutions, IST Edition, 2009 PHI Learning.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Distinguish** between different networking models like TCP/IP and OSI.	L 4
2.	**Identify** different data transmission modes along with error detection and correction techniques.	L 3
3.	**Analyse and classify** routing and congestion control algorithms in data transmission.	L 4
4.	**Examine** the working principles of various transport and application protocols.	L 4
5.	**Compare** the design issues, services, interfaces, protocols and flow of data in computer networks and **Evaluate** different performance issues related to networking.	L 5

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will develop confidence for self-education and ability for life-long learning	**10**
3.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Python Programming (Theory)

Course Code	**18MCA32**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear understanding of python programming, its applications in real world and to differentiate the syntax of python from other programming languages.
2. To emphasize on various data structures provided by python library including string, list, dictionary etc.
3. To provide knowledge about development of graphical user interfaces and databases.
4. To emphasize on various applications of NumPy arrays and Pandas.
5. To explore various packages to visualize data.

Pre-requisites:

- Basic Programming knowledge

Unit - I **12 Hours**

Variables and Simple data types

Variables: Naming and Using Variables, Avoiding Name Errors When Using Variables. Strings: Changing Case in a String with Methods, Combining or Concatenating Strings, Adding Whitespace to Strings with Tabs or Newlines, Stripping Whitespace. Numbers: Integers, Floats, Avoiding type errors with the str() function.

Working with Lists

What is a list? Accessing elements in a list, Using individual values from a list, Modifying elements in a List, Adding elements to a List, Removing elements from a List

Organizing a list:Sorting a list permanently with the sort() method, Sorting a list temporarily with the sorted() function, Printing a list in reverse order, finding the length of a list, Looping through an entire list, Making numerical lists, Simple statistics with a list of numbers, List comprehensions, working with part of a list, looping through a slice, copying a list, Moving items from one list to another, Removing all instances of specific values from a list

Working with Dictionaries

Accessing values in a dictionary, Adding new key-value pairs, starting with an empty dictionary, modifying values in a dictionary, removing key-value pairs, a dictionary of similar objects, looping through a dictionary, Filling a dictionary with user input.

Tuples

Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples.

User Input

How the input() function works?, Using int() to Accept Numerical Input.

Unit - II **10 Hours**

Functions

Defining a function, Passing arguments: positional arguments, keyword arguments, and default values; Return values:returning a simple value,returning a dictionary; Passing a list: Modifying

a list in a function; Passing an arbitrary number of arguments: Mixing positional and arbitrary arguments,Using arbitrary keyword arguments; Storing your functions in modules: Importing an entire module, Importing specific functions, Using as to give a function an alias, Using as to give a module an alias, Importing all functions in a module.

Classes

Creating and using a Class: the __init__() method, Making an instance from a class, accessing attributes, calling methods, creating multiple instances; Working with classes and instances: setting a default value for an attribute, Modifying attribute values.

Graphical User Interfaces

The TkinterModule, Basic GUI Construction, Models, Views, and Controllers, Style, A Few More Widgets, Object-Oriented GUIs.

Unit - III **10 Hours**

Databases

Importing SQLite and MySQL database libraries, Use of database module's connect method, creation of tables and inserting data into tables, saving changes, retrieving data through queries, Updating and Deleting, Transactions, Using NULL for Missing Data, Using Joins to Combine Tables, Keys andConstraints.

NumPy Basics: Arrays and Vectorized Computation

The NumPyndarray: Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes; Universal Functions: Fast Element-Wise Array Functions; Array-Oriented Programming with Arrays: Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic.

Unit - IV **10 Hours**

Getting Started with pandas

Introduction to pandas Data Structures: Series, DataFrame, Index Objects; Essential Functionality: Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels; Summarizing and Computing Descriptive Statistics: Correlation and Covariance, Unique Values, Value Counts, and Membership.

Data Loading, Storage, and File Formats

Reading and Writing Data in Text Format: Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, JSON Data, Web Scraping.

Unit - V **10 Hours**

Plotting and Visualization

A Brief matplotlib API Primer: Figures and Subplots, Colors, Markers, Line Styles, Ticks, Labels, Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration; Plotting with pandas and seaborn: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Case studies

- A casestudy on encapsulation, generalization and interface design of functions by using Python turtle module.
- Application of Python's core data structure: for Word frequency analysis, for creating histogram of words in a file, for finding the most common words.
- Interacting with Web APIs.
- A casestudy on essential statistics for data science using pandas,matplotlib and seabornibraries.

	Text Books:
1.	Eric Matthes: Python Crash Course: a hands-on, project-based introduction to programming, No Starch Press, 2015
2.	Paul Gries, Jennifer Campbell, Jason Montojo: Practical Programming- An introduction to Computer Science using Python, second edition, The Pragmatic Bookshelf, 2013.
3.	Wes McKinney: Python for Data Analysis- Data Wrangling with Pandas, NumPy, and IPython,2nd edition, 2017
4.	Allen B. Downey: Think Python- How to Think Like a Computer Scientist, 2nd edition, O'Reilly, 2015
	E-Resources
1.	https://www.learndatasci.com/tutorials/data-science-statistics-using-python/

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Illustrate** variables, data types list, dictionaries, tuples in python and **apply** the same in programs.	L 3
2.	**Summarize** functions, classes and **build** graphical user interfaces	L 3
3.	**Make use of** databases and **Analyze** NumPy arrays	L 4
4.	**Analyze** Pandas and **summarize** data loading, file formats, storage.	L 4
5.	**Assess** different plotting and visualization methods.	L5

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.	**2**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	**3**
3.	Post graduates will develop confidence for self-education and ability for life-longlearning.	**10**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Cloud Computing (Theory)

Course Code	**18MCA33**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To impart fundamental concepts in the area of cloud computing.
2. To give an insight in to knowledge applications of cloud computing.
3. To explore the cloud computing paradigm.
4. To expose features of cloud security.

Pre-requisites :

- Operating Systems (18MCA23)

Unit – I **11 Hours**

Introduction to Cloud Computing and Distributed System Models

Introduction to Cloud Computing: Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2.

Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing, System Models for Cloud and Distributed Computing: Clusters of Cooperative Computers, Energy efficiency in distributed computing.

Unit – II **10 Hours**

Cloud Resource Virtualization

Virtualization, Layering and Virtualization, Virtual machine monitors, Virtual machines, Performance and Security Isolation, Full Virtualization and Paravirtualization, Hardware support for Virtualization, Case Study: Xen, a VMM based on Paravirtualization, The darker side of Virtualization.

Unit – III **10 Hours**

Cloud Resource Management and Scheduling

Policies and Mechanisms for Resource Management, Stability of Two-Level Resource Allocation Architecture, Feedback control Based on Dynamic Thresholds, Resource Building: Combinatorial Auctions for Cloud Resources, Scheduling Algorithms for Computing Clouds, Fair Queuing, Resource Management and Dynamic Application Scaling.

Unit – IV **10 Hours**

Cloud Computing Platforms

Cloud computing platforms: Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform. Online social and Professional Networking: Online Social Network characteristics, Graph-Theoretic Analysis of Social networks, Communities and Applications of Social Networks, Facebook: The World's Largest Content-Sharing Network, Twitter for Micro blogging, News and Alert Services.

Unit - V **11 Hours**

Cloud Security Basics

Cloud security fundamentals: Vulnerability assessment tool for cloud, Privacy and Security in cloud computing security architecture: Architectural Considerations General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Microarchitectures; Identity Management and Access Control, Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management, virtual threats, VM Security Recommendations, VM-Specific Security techniques.

	Text Books:
1.	Kai Hwang, Jack Dungaree, and Geoffrey Fox, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012.
2.	Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, Cloud Computing for Dummies, Wiley India Edition.
3.	Kumar Saurabh, Cloud Computing – insights into New -Era Infrastructure, Wiley India, 2011.
4.	Dan C. Marinescu, cloud Computing Theory and Practice, Elsevier Inc., 2013
5.	Ronald Krutz and Russell Dean Vines, Cloud Security, Wiley-India.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** fundamental concepts of cloud computing, distributed computing and clustering.	L 3
2.	**Interpret and analyse** the cloud resource virtualization, security isolation, the darker side of virtualization.	L 4
3.	**Apply** and **organize** cloud resource management and scheduling algorithms for computing clouds.	L 6
4.	**Appraise** different cloud platforms and **evaluate** their performance.	L 5
5.	**Assess** the importance and challenges of cloud security.	L 5

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Introduction to server-side programming using PHP(Theory)

Course Code	**18MCA34**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To impart training to use PHP's comparison and logical operators in conditional statements and loops to make PHP scripts respond intelligently to different events.
2. To emphasize on grouping related data into PHP arrays and define your own functions for greater reusability of PHP code.
3. To provide knowledge about classes, objects, inheritance.
4. To impart knowledge on obtaining, installing, configuring, and test a PHP-MySQL development environment.
5. To provide an understanding of the working of cookies and sessions.

Pre-requisites :

- Web Programming (18MCA12)

Unit - I — 10 Hours

Introduction to PHP

The Structure of PHP, Using Comments, Basic Syntax, Understanding Variables, Operators, Variable Assignment, Multiple-Line Commands, Variable Typing, Constants, The Difference Between the echo and print Commands, Functions, Variable Scope.

Expressions and Control Flow in PHP: Expressions, Operators, Conditionals, Looping, Implicit and Explicit casting, PHP dynamic linking.

PHP arrays: Basic access, numerically indexed arrays, associative arrays, assignment using the array keyword, the foreach…as loop, multidimensional arrays, using array functions.

Unit - II — 11 Hours

PHP Functions and Objects

Defining a function, returning a value, returning an array, passing by reference, returning global variables, including and requiring files. PHP objects: Terminology, declaring a class, creating an object, accessing an object, constructors, writing methods, declaring properties, declaring constants, property and method scope in PHP 5, inheritance.

Unit - III — 10 Hours

Practical PHP

Using printf, date and time functions, File Handling: Checking whether a file exists, creating a file, reading from a file, copying files, moving a file, deleting a file, updating files, locking files for multiple access, reading an entire file, uploading files.

XHTML: Benefits of XHTML, XHTML versions, What is different? HTML 4.01 document types, XHTML 4.01 document types, XHTML validation.

Unit - IV **11 Hours**

Accessing MySQL Using PHP

Querying a MySQL Database with PHP, The Process, creating a Login File, connecting to a MySQL Database, Practical MySQL, creating a Table, describing a Table, dropping a Table, Adding Data, Retrieving Data, Updating Data, Deleting Data.

MySQL Triggers: Introducing triggers, Why Use Triggers? Taking Action Before an Event, Taking Action After an Event, Before Triggers vs. After Triggers. **Stored Routines:**Should You Use Stored Routines? How MySQL Implements Stored Routines.

Unit - V **10 Hours**

Form Handling

Building Forms, Retrieving Submitted Data, Default Values, Input Types, Sanitizing Input, An Example Program.

Cookies, Sessions, and Authentication: Using Cookies in PHP, setting a Cookie, accessing a Cookie, destroying a Cookie, HTTP Authentication, Storing Usernames and Passwords, Salting, Using Sessions, starting a Session, ending a Session, Setting a Time-Out, Session Security.

Case study using ZEND framework

Books	
	Text Books:
1.	Robin Nixon, Learning PHP, MySQL & JavaScript, 1st Edition, O'Reilly.
2.	Robert Sebesta, Programming the World Wide Web, 4th Edition, Pearson.
3.	W. Jason Gilmore, Beginning PHP and MySQL from Novice to Professional, 4th Edition, Apress.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** the fundamental PHP concepts.	L 4
2.	**Determine** the concept of functions and OOP in PHP.	L 5
3.	**Apply** concept of arrays and methods of file handling.	L 3
4.	**Develop** database applications usingMySQL and PHP.	L 6
5.	**Design and build** dynamic web applications using HTML forms, cookies, sessions and MVC framework.	L 6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Elective - 1
System Software (Theory)

Course Code	**18MCA351**	**Credits**	03
Course type	FE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear idea of design and implementation of various types of system software.
2. To impart the relationship between Machine architecture and System software.
3. To explore Machine-independent aspects of software design and machine-specific details.
4. To give an insight into the system programs for SIC / SIC/XE machine.
5. To explore the need of Lex and Yacc tools for writing compilers and interpreters.

Pre-requisites :

- Digital systems and computer organization (18MCA13)
- Data Structures (18MCA14).

Unit - I **09 Hours**

Machine Architecture and Assemblers - I

Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

Unit - II **09 Hours**

Assemblers - II and Loaders

Machine Independent Assembler Features – Literals, Symbol, Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One-Pass Assembler, Multi-Pass Assembler.

Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine- Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader.

Unit - III **09 Hours**

Linkers, Editors and Debugging Systems

Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders.

Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities.

09 Hours

Unit - IV

Macro Processors

Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features – Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters**.**

Unit - V 09 Hours

Compilers, Lex and Yacc

Language processors, The structure of a compiler, The evolution of programming languages.
The simplest Lex program, recognizing words with Lex, Symbol tables, Grammars, the parts of speech Lexer, A Yacc parser, the rules section, Running Lex and Yacc, Using Lex- regular expressions, a word counting problem.
Using Yacc- Grammers, Recursive rules, Shift/reduce parsing, A Yacc parser- definition section, the rules section, Symbol values and actions, The Lexer, Compiling and running a simple parser.

Books	
	Text Books:
1.	Leland.L.Beck: System Software, 3rd Edition, Addison-Wesley, 1997
2.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, techniques and tools, 2nd Edition, Pearson – 2011
3.	M.Dhamdhere: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999
4.	John J. Donavan , Systems Programming, Tata McGraw –Hill Publishing company Ltd, New Delhi, 1991
5.	John R. Levine, Tony Mason & Doug Brown, Lex&Yacc, O'reilly, 1992

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** and **explain** the architecture of SIC and SIC-XE machine with an illustration of the role of system programming in computer operation	L 3
2.	**Analyze** working of assemblers in terms of their machine dependency	L 4
3.	**Compare** between machine independent and machine specific details of Assemblers, Loaders, and Macro processors	L 4
4.	**Assess** Loaders, Linkers, Macro processor and Text editors	L 5
5.	**Explain** the phases of compilersand **Develop** simple Lex and Yacc programs	L 6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
3.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Linux Administration

Course Code	**18MCA352**	**Credits**	03
Course type	FE	**CIE Marks**	50 marks
Hours/week: L-T-P	2-0-1	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the basic system administration tasks and to describe how to manage software packages on Fedora using Yum.
2. To impart the knowledge of configuration of the services to be run when a system is started, and also to provide emphasis on Apache HTTP Server 2.2 and Mail Servers
3. To introduce the installation and configuration process of OpenLDAP 2 and samba server.
4. To provide an overview of the configuration of the rsyslog daemon and to impart knowledge to locate, view and monitor log files.
5. To provide an overview of the cron, at and batch utilities.

Pre-requisites :

- Basic understanding of the Fedora operating system

Unit - I — 09 Hours

Basic System Configuration and Package Management

Opening Graphical Applications, System Locale and Keyboard Configuration: Setting the System Locale, Changing the Keyboard Layout, Managing Users and Groups; Introduction to Users and Groups, Managing Users in a Graphical Environment. **Package Management, Services and Daemons-** Yum: Checking For and Updating Packages, Packages and Package Groups, Configuring Yum and Yum Repositories. Configuring Services, Running Services OpenSSH: The SSH Protocol, An Open SSH Configuration, Open SSH Clients.

Unit - II — 09 Hours

Web and Mail Servers

Web Servers- The Apache HTTP Server, Updating the Configuration, Running the httpd Service, Editing the Configuration Files, Working with Modules , Setting Up Virtual Hosts, Setting Up an SSL Server. Mail Servers- Email Protocols, Email Program Classifications, Mail Transport Agents, Mail Delivery Agents, Mail User Agents.

Unit - III — 09 Hours

File and Directory Servers

FTP Servers: The File Transfer Protocol, FTP Servers, Files Installed with vsftpd, Starting and Stopping vsftpd, vsftpd configuration Options. Runing FTP Server. **Samba Server -** Introduction to Samba, Samba Daemons and Related Services, Connecting to a Samba Share, Configuring a Samba Server ,Starting and Stopping Samba, Samba Server Types and the smbconf File, Samba Security Modes, Samba Account Information Databases, Samba Network Browsing , Samba with CUPS Printing Support, Samba Distribution Programs. **Directory Servers -**OpenLDAP, Introduction to LDAP, Installing the OpenLDAP Suite , Configuring an OpenLDAP Server , SELinux Policy for Applications Using LDAP, Running an OpenLDAP Server, Configuring a System to Authenticate Using OpenLDAP

Unit - IV **09 Hours**

Viewing and Managing Log Files

Locating Log Files, Basic Configuration of Rsyslog, Working with Queues in Rsyslog , Using Rsyslog Modules , Interaction of Rsyslog and Journal, Structured Logging with Rsyslog , Debugging Rsyslog, Using the Journal, Managing Log Files in a Graphical Environment. Working with the GRUB 2 Boot Loader: Configuring the GRUB 2 Boot Loader, Customizing GRUB Menu, GRUB 2 Password Protection, Reinstalling GRUB , GRUB 2 over Serial Console, Terminal Menu Editing During Boot, UEFI Secure Boot

Unit - V **09 Hours**

Automating System Tasks :

-Cron and Anacron- Installing Cron and Anacron, Running the Crond Services, Configuring Anacron Jobs, Configuring Cron Jobs, Controlling Access to Cron,Black and White Listing of Cron Jobs At and Batch-Installing At and Batch,Running the At Service, Configuring an At Job, Configuring a Batch Job, Viewing Pending Jobs, Additional Command Line Options, Controlling Access to At and Batch.

Books	
	Text Books:
1.	JaromírHradílek, Douglas Silas, Martin Prpič, Stephen Wadeley, EliškaSlobodová, Tomáš , Čapek, Petr Kovář, Miroslav Svoboda, Fedora 21 System Administrator's Guide Deployment, Configuration, and Administration of Fedora 21, Edition 1.0
2.	Kemp, Juliet, Spinger, "Linux System Administration"
3.	SjaakLaan "Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Kindle Edition, Lulu Press Inc; Second Edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Experiment with** the basic system administration tasks and how to manage software packages on Fedora using Yum.	L 3
2.	**Illustrate** the configuration of the services to be run when a system is started and **Make use of** Apache HTTP Server 2.2 and Mail Servers.	L 3
3.	**Experiment with** installation and configuration process of OpenLDAP 2 and samba server.	L 3
4.	**Utilize** the configuration process of rsyslog daemon and also log files monitoring.	L 3
5.	**Make Use of** utilities for automating system tasks.	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	5
2.	Postgraduates will develop confidence for self education and ability for life-long learning	10

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50** ➢				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Enterprise Resource Planning

Course Code	**18MCA353**	**Credits**	03
Course type	FE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To impart a basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
2. To help build an understanding of the fundamental concepts of ERP systems
3. To provide a basic understanding of the modules used in ERP systems.
4. To provide an understanding of the roles of various people involved in the implementation and use of ERP systems
5. To provide an understanding of the managerial issues involved in the design and implementation of ERP Systems and focus on the benefits that may be realized from an ERP system and on the management of benefits from the ERP system.

Pre-requisites :

- **Software Engineering (18MCA24)**

Unit - I 09 Hours

Introduction to ERP: Introduction, Common ERP myths, Reasons for the growth of ERP market, Advantages of ERP. Justifying ERP investments: Quantifiable benefits from an ERP system, Intangible benefits of ERP. ERP and related technologies: Business Process Reengineering, Business Intelligence, Data Warehousing.

Unit - II 09 Hours

ERP implementation life cycle: Objectives of ERP implementation, different phases of ERP implementation, ERP implementation-the hidden costs. Vendors and Consultants: In-house implementation pros and cons, Vendors, role of vendors, Consultants, role of consultants, Employee and employee resistance: Reasons for employee resistance.

Unit - III 09 Hours

Business modules of an ERP package: Functional modules of ERP software, Financials, Human Resource management, Plant maintenance, Marketing, Quality Management.

Unit - IV 09 Hours

ERP – Present and Future: Turbo Charge the ERP System, EIA, ERP and E–Commerce, ERP and Internet

Unit - V **09 Hours**

ERP Market and ERP vendors: ERP Market Place, SAP AG, PeopleSoft, Baan Company, JD Edwards

	Text Books:
1.	Alexis Leon ERP Demystified, Tata McGraw Hill, Third edition.
2.	Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, Concepts in Enterprise Resource Planning, Thomson Learning, 2001.
3.	Vinod Kumar Garg and N.K .Venkata Krishnan, Enterprise Resource Planning concepts and Planning, Prentice Hall, 1998.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Examine** the basic concepts in Enterprise Systems.	L 4
2.	**Identify** the challenges associated with implementing enterprise systems and their impacts on organizations.	L 3
3.	**List** the different ERP modules in detail.	L 4
4.	**Assess** the present and future of ERP and its integration with E-Commerce and internet.	L 5
5.	**Analyze** the ERP market place and the several popular ERP packages to support business operations and decision-making.	L 4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**
3.	Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional.	**9**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Object Oriented Modeling and Design Patterns

Course Code	**18MCA354**	**Credits**	03
Course type	FE	**CIE Marks**	50 marks
Hours/week: L-T-P	2-0-1	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To emphasize on analysis and create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2. To focus on modeling and how Unified Modeling Language (UML) represents object-oriented system using different modeling views, and pointing out the importance and function of each UML model throughout the process of object-oriented analysis and design.
3. To provide knowledge of different types of patterns (structural, communication, management etc) for development of software.

Pre-requisites :

- Programming using JAVA (18MCA21)

Unit - I 09 Hours

Introduction, Modeling Concepts, Class Modeling and Advanced Class Modeling

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development. Modeling as Design Technique: Modeling; abstraction; the three models, Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. Advanced object and class concepts; Association ends; N-array associations; Aggregation; Abstract classes; Multiple inheritance.

Unit - II 09 Hours

State Modeling and Advanced State Modeling, Interaction Modeling and Advanced Interaction Modeling

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model. Interaction Modeling: Use case models; Sequence models; Activity models.

Unit - III 09 Hours

Design Patterns

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. Introduction, structural decomposition, Model View Controller; how design patterns solve designproblems, how to select a design pattern, how to use a design pattern.

09 Hours

Unit - IV

Pattern Catalog

Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, Proxy. Communication Patterns: Client-Dispatcher-Server; Publisher-Subscriber;Management Patterns: Command processor

Unit - V

09 Hours

Introduction to Idioms and simple examples

Case Studies on concepts learnt

- Implementation of singleton pattern
- Implementation of whole -part pattern
- Implementation of polymorphism pattern.

Analyze, design and implementation of the following systems using UML 2.0 notations.

- College maintenance department management system.
- Department admission process management system.

	Text Books:
1.	Michael Blaha, James Rumbaugh, Object-Oriented Modeling and Design with UML 2nd Edition, Pearson Education / PHI, 2005
2.	Frank Bachmann, ReginеMeunier, Hans Rohnert , Patter n Oriented Software Architecture, Volume 1, 1996.
3.	Design patterns, erich gamma, Richard helan, Ralph johman , John Vlissides ,Pearson Publication,2013

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** modeling concepts and class modeling.	**L4**
2.	**Design** state models. Interaction models using UML notations.	**L6**
3.	**Discuss** notion of design patterns.	**L6**
4.	**Apply** and implement different structural patterns for different domains.	**L3**
5.	**Apply** knowledge of UML, Object Oriented Development and Patterns in different case studies	**L3**

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Computer Networks Laboratory

Course Code	**18MCA36**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To explore features of NS2 network simulator.
2. To introduce the basic design and implementation of various types of network topologies.
3. To impart performance analysis using network simulator NS2.
4. To emphasize and explore the implementation of framing and congestion control mechanisms using higher programming languages like C/C++.

Pre-requisites :

- Computer Networks(18MCA31)

List of experiments

Minimum 6 experiments can be framed on the following topicsusing free and open source network simulator NS2 and tool command language (TCL) as scripting language.

1. Star topology
2. LAN Wired Network
3. Client - Server architecture
4. Bottleneck Analysis of network
5. Distance Vector Routing algorithm implementation
6. Wireless Network

Minimum 2 experiments in C / C++ :

7. Framing techniques
8. Traffic shaping techniques

	Books
1.	Andrew S Tanenbaum, David J Wetheral ,Computer Networks , 5th Edition, Pearson 2012.
2.	William Stallings , Data and Computer Communications , Above 7th edition , 2004
3.	NatalaOlifer and Victor Olifer, Computer Networks Principles, Technologies and Protocols for Network Design, 2010.
4.	Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
	E-Recourses
1.	http://www.isi.edu/nsnam/ns/ns-documentation

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Develop** the TCL script for linking of nodes, agents, and application protocol on nodes and **Plan** a simulation program for given network scenario,	**L 3**
2. **Analyze simulation program** Grep command / AWK script to extract features from the trace file to determine the various Networking factors.	**L 4**
3. **Analyze** wired and wireless topology with features like trace files, Xgraph, NAM of NS2.	**L 4**
4. **Construct a** C/C++ program forframing concepts and Traffic shaping techniques.	**L 3**
5. **Plan** a simulation program for given network scenario.	**L 6**

Program Outcome of this course (POs)	PO No.
1. Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2. Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
3. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Python Programming Laboratory

Course Code	**18MCA37**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide a clear understanding of python programming, its applications in real world.
2. To emphasize on various data structures provided by python library including string, list, dictionary, NumPy arrays and Pandas.
3. To provide knowledge about development of graphical user interfaces and databases.
4. To explore various packages to visualizedata.

Pre-requisites :

- Python Programming(18MCA32)

List of experiments

Minimum8 experiments can be framed on the following topics

1. Lists
2. Dictionaries
3. Functions andClasses
4. Graphical UserInterfaces
5. Databases using SQLite and MySQL databaselibraries
6. NumPy Basics andPandas
7. Reading and Writing Data in different fileformats
8. Plotting and Visualizationtools

Books	
1.	Paul Gries, Jennifer Campbell, Jason Montojo: Practical Programming- An introduction to Computer Science using Python, second edition, The Pragmatic Bookshelf, 2013.
2.	Wes McKinney: Python for Data Analysis- Data Wrangling with Pandas, NumPy, and IPython,2nd edition, 2017

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Utilize** Lists, Tuples and Dictionaries.	**L3**
2. **Identify** and **Interpret** functions and class concepts.	**L3**
3. **Build** applications using Graphical User Interfaces and Databases	**L3**
4. **Analyze** NumPy and Pandas library **Apply** Plotting and Visualization packages	**L4** **L3**
5. **Utilize** Lists, Tuples and Dictionaries.	**L3**

Program Outcome of this course (POs)		PO No.
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Post graduates will develop confidence for self education and ability for life-long learning	**10**

Program Specific Outcomes (PSOs)		PO. No.
1.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success. [PSO 2]	**2**
2.	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies. [PSO 3]	**3**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20/50 (10/25)		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

PHP Programming Laboratory

Course Code	**18MCA38**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide an understanding of the fundamentals of scripting variables, conditional and iterative execution, methods, etc.
2. To provide an understanding of sessions, cookies, triggers, stored procedures and database connectivity using MySQL.

Pre-requisites :

- Introduction to Server side programming using PHP (18MCA34)

List of experiments

Minimum 8 experiments can be framed on the following topics

1. Arrays
2. Functions
3. OOPS
4. File handling
5. Form handling
6. Sessions and cookies
7. Form handling with database access,
8. Triggers

Books	
1.	Robin Nixon, Learning PHP, MySQL & JavaScript, 1st Edition, O'Reilly.
2.	Robert Sebesta, Programming the World Wide Web, 4th Edition, Pearson.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Make use of** HTML and PHP to develop proper web applications	L 3
2. **Identify** when it is appropriate to use server side programming such as PHP and to write simple PHP code to perform some functionality for a web application	L 3
3. **Develop** a simple web application using MySQL database	L 6

Program Outcome of this course (POs)		PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**

Program Specific Outcomes (PSOs)		PO. No.
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	**1**
2.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success. [PSO 2]	**2**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

IV Semester
Analysis and Design of Algorithms

Course Code	**18MCA41**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide clear understanding of algorithms.
2. To make understand the concepts of parallel programming
3. To elaborate design of algorithms, manipulate algorithms, understand algorithms, analyze algorithms, compare algorithms, and appreciate the working of an efficient algorithm
4. To impart the knowledge of algorithmic power and how the limitation can be coped up by using design techniques like backtracking and branch-and-bound, and finally conclude with a discussion of few approximation algorithms
5. To explore analytical skills and problem-solving skills.

Pre-requisites :

- Data Structures (18MCA14)
- Discrete Mathematical Structuress (18MCA15)

Unit - I **11 Hours**

Introduction, Analysis of algorithmic efficiency

Notion of Algorithm, Fundamentals of algorithmic problem solving, important problem types, fundamental data structures, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Examples

Unit - II **11 Hours**

Brute Force, Divide and Conquer

Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching, Exhaustive Search for Travelling Salesman Problem, Knapsack Problemand Assignment Problem. Introduction to divide and conquer technique, Merge Sort, Quick Sort, Binary Search, multiplication of large integers.

Unit - III **10 Hours**

Decrease and Conquer , Space and Time Tradeoffs

Insertion sort, Depth First Search, Breadth First Search, Topological Sorting, sorting by counting, Input Enhancement in string matching,

Unit - IV **10 Hours**

Dynamic Programming, Greedy Method

Warshall's Algorithm, Floyd's Algorithm, 0/1 Knapsack, Greedy Knapsack Problem, Prim's Algorithm, Kruskal's Algorithm, Dijikstra's Algorithm, Huffman Trees

Unit - V **10 Hours**

Coping with Limitations of Algorithmic Power

Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems. Backtracking: n - Queens's problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem

	Text Books:
1.	AnanyLevitin: "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2007.
2.	Thomas H. Cormen, Charles E Leiserson, Ronald R. Livest, Clifford Stein, "Introduction to Algorithms",2nd Edition, McGraw-Hill, 2001
3.	Ellis Horowitz, SartajSahni, SanguthevarRajasekaran: "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** the algorithm efficiency using general framework.	L4
2.	**Make use of** general method to solve problems like Knapsack and Job sequencing with Deadlines	L3
3.	**Apply** different strategies for searching and sorting the elements in given list	L3
4.	**Solve** by applying different strategies like Dynamic Programming and Greedy Techniques to solve graphical problems	L3
5.	**Demonstrate** the mathematical analysis of recursive algorithms and non-recursive algorithms with relevant examples	L3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	2
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	5
3.	Postgraduates can participate and succeed in competitive examinations	11

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Programming using J2EE

Course Code	**18MCA42**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the core components of advanced Java programming language like JSP, servlets, JDBC, Java Beans and EJB.
2. To explore servlet life cycle and handling request headers, response headers, and status codes in servlets.
3. To elaborate life cycle of JSP with the advantages of JSP and how to make use of action tags, implicit objects, directive tags, and script let tags.
4. To explore JAR file and importance of different Annotations.
5. To explore database connectivity using JDBC connection API.
6. To impart the knowledge of types of EJB's, life cycle of Server Side EJB components and Entity bean.

Pre-requisites :

- Programming using Java (18MCA21)

Unit - I 12 Hours

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 - II 10 Hours

Java Server Pages

Overview of JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, Invoking java code with JSP scripting elements, Invoking java code from JSP, limiting java code in JSP, using JSP expressions, comparing servlets and JSP, writing scriptlets, scriptlet example Using scriptlets to make parts of JSP conditional, using declarations, declaration example.

Unit - III 10 Hours

Controlling the Structure of generated servlets

the JSP page directive, import attribute, session attribute, isELignored attribute, buffer and auto flush attributes, info attribute, errorPage and isErrorPage attributes, isThreadsafe Attribute, extends attribute, language attribute, Including files and applets in JSP Pages, using Java beans components in JSP documents.

Unit - IV **10 Hours**

JDBC

Talking to Database, Types of JDBC, Essential JDBC program, JDBC Drivers, packages, Callable Statement, Statement Objects, using Prepared Statement JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types

Annotations

JAR files and Annotations. The core Java API package, New Java. Lang Sub package, Built-in Annotation**s.**

Unit - V **10 Hours**

Introduction to EJB and Server Side Components Model

The Problem domain, the Enterprise Java bean specification. Components Types. Server Side Component Types, Session Beans, Stateful Session Bean, Stateless Session bean, Singleton Session bean, Message Driven Beans, Entity Beans, Container services .Dependency Injection, Concurrency, Instance pooling and caching, Transactions, Security, Timers ,Naming and object stores, Interoperability, life cycle call backs ,Interceptors, platform integration ,Application development using stateless session bean and stateful session bean.

Text Books:	
1.	Marty Hall, Larry Brown, Core Servlets and Java Server Pages. Volume 1: Core Technologies. Second Edition
2.	Herbert Schildt, Java The Complete Reference, Eight Edition. Tata McGraw-Hill Edition – 2011
3.	Andrew Lee Rubinger, Bill Burke. Developing Enterprise Java Components. Enterprise JavaBeans 3.1.O'reilly
4.	Java 6 Programming Black Book, Dreamtech Press. 2012
5.	Web Technologies: HTML, Javascript, XML and , PHP, Java, JSP ASP.net, Ajax Black Book Kogent learning Solutions Inc/Wiley India 2008

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Develop** web applications using servlets to process client request, cookies and session tracking.	L6
2.	**Develop simple** web applications using Java Server Pages with JSP scripting elements and implicit variables.	L6
3.	**Construct** powerful web applications using Java Server Pages with JSP action tags, directive tags and Java Beans	L3
4.	**Apply** JDBC API to access the different databases like MySQL, Oracle and DB2 from Java applications	L3
5.	**Build** EJBApplications, which are distributed in nature using different server side component types such as session ,entity bean etc.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50** ➢				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Introduction to Big Data Paradigm

Course Code	**18MCA43**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To emphasize on big data dimensions and its applications with case studies.
2. To explore Hadoop framework and architecture
3. To emphasize the importance of Map Reduce framework
4. To explore big data tools and technologies : Pig and Hive
5. To introduce visualization techniques on data to analyze and provide business insights using tableau.

Pre-requisites :

- Programming using Java(18MCA21)

Unit - I — 10 Hours

Overview of Big data: What is Big data? Structuring Big data, Elements of Big data, Advantages of Big data, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities; Use of Big Data in Retail Industry

Unit - II — 10 Hours

Hadoop Ecosystem : Understanding Hadoop Ecosystem, Hadoop Distributed File System: HDFS Architecture, Concept of Blocks in HDFS Architecture, NameNodes and Data Nodes, The Command-Line Interface, Using HDFS Files, Hadoop-Specific File System Types, HDFS Commands, The org.apache.hadoop.io package, HDFS High availability:Features of HDFS.

Unit - III — 11 Hours

Understanding Map Reduce: The Map Reduce Framework: Exploring the Features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Uses of Map Reduce, YARN Architecture: Background; Advantages of YARN

Unit - IV — 10 Hours

Introducing Hive : Getting started with Hive, Hive Services, Data types in Hive, Built-in Functions in Hive

Analyzing Data with Pig: Introduction to Pig: The Pig Architecture, Benefits of Pig,

Unit - V — 11 Hours

Data Visualization : Introduction, Techniques used for visual Data Representation, Types of Data, Visualization, Applications of Data, Visualization, Visualizing Big, Data, Tools used, Visualization, Tableau Products

Data Visualization with Tableau– Introduction to Tableau software, Tableau Workspace, Data Analytics in Tableau Public, Using visual controls in Tableau Public

Books	
	Text Books:
1.	DT Editorial Services Big Data – Black Book Dreamtech Press, Edition – 2015, ISBN - 978-93-5119-931-1.
2.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis,Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012
3.	P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012.
4.	Tom White, Hadoop: The Definitive Guid, Third Edition, O'Reilly, 2012

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the importance of Big Data, its characteristics and use of Big Data in different fields or sectors.	L 3
2.	**Analyze**the ecosystem of Hadoop	L 4
3.	**Apply** map reduce framework in analyzing the data and relate to YARN	L 3
4.	**Explain** thetools in analyzing the data and managing Big Data	L 5
5.	**Analyze** the data using the visualization technique like tableau.	L 4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Elective - 2
Advanced Database Management System

Course Code	**18MCA441**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a clear understanding of the architectural and algorithmic aspects of Data Base Management System(DBMS)
2. To emphasize about advanced database with the concepts of storage, indexing, transaction management, structure, relational operators and query optimization.
3. To emphasize on knowledge about evaluation of queries and query optimization.
4. To provide knowledge about physical database design and database tuning.

Pre-requisites :

- Operating systems (18MCA23).
- Database management system (18MCA22).

Unit - I **9 Hours**

Overview of Storage and Indexing

Overview of Storage, Indexing, Disks and Files, Data on external storage; File organizations and Indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning; Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats.

Transaction Management and Crash recovery

Transaction Management Introduction to Transaction Processing; Transaction and System Concepts; Desirable Properties of Transactions; Characterizing Schedules based on Recoverability; Characterizing Schedules based on Serializability; Two-Phase Locking Techniques, Concurrency Control based on Timestamp Ordering. Granularity of Data Items and Multiple Granularity Locking; Recovery Concepts, Recovery Techniques based on Deferred Update; Recovery Techniques based on Immediate Update; Shadow Paging; The ARIES Recovery Algorithms; Recovery in Multi-database Systems; Database Backup and Recovery from Catastrophic Failures.

Unit - II **9 Hours**

Tree-Structured Indexing

Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ tress in practice

Hash-Based Indexing

Hash-Based Indexing: Static hashing, Extendible hashing, linear hashing, comparisons

Unit - III **9 Hours**

Overview of Query Evaluation

The system catalog, Introduction to operator evaluation; Algorithm for relational operations; Introduction to query optimization; Alternative plans; A motivating example; What a typical optimizer does.

External Sorting

When Does a DBMS sort data?, A simple two-way merge sort; External merge sort

Unit - IV **9 Hours**

Evaluating Relational Operators

The Selection operation; General selection conditions; The Projection operation; The Join Operation; The Set operations; Aggregate operations; The impact of buffering.

A Typical Relational Query Optimizer

Translating SQL queries in to Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans

Unit - V **9 Hours**

Physical Database Design and Tuning

Introduction to physical database design; Guidelines for index selection, Basic examples of index selection; Clustering and indexing; Indexes that enable index-only plans, Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking; Case Study.

Text Books:	
1.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill,2003.
2.	Elmasri and Navathe:Fundamentals of Database Systems,5th Edition, Pearson Education, 2007.
3.	Conolly and Begg: Database Systems,4th Edition, Pearson Education,2002.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1	**Summarize** the fundamental of storage, indexing, transaction management concepts and **Assess** various Recovery Techniques.	L 5
2.	**Analyze** the different indexing structures and **Evaluate** it.	L 5
3.	**Appraise** the concepts of query evaluation and external sorting of data.	L 4
4.	**Evaluate** relational operators and query plans.	L 5
5.	**Interpret** and **summarize** the large volume data with its design and performance tuning	L 5

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Internet of Things

Course Code	**18MCA442**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	2-0-1	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the Internet of Things, basics and fundamentals.
2. To present the techniques of interfacing the modules and with IoT systems.
3. To understand the case studies / applications of IoT and develop the skills of designing IoT applications.

Pre-requisites :
Basics of Programming, Basics of Networking.

Unit - I 09 Hours

Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process.
Case studies / applications.

Unit - II 09 Hours

Introduction To Internet Of Things: Definition and Characteristics of IoT, physical design of IoT, IoT Protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates.

Case studies / applications.

Unit - III 09 Hours

Prototyping IoT Objects Using Microprocessor/Microcontroller: Working principles of sensors and actuators. Setting up the board - Programming for IOT. Reading from Sensors, Communication**:**communication through Bluetooth, Wi-Fi.

Case studies / applications.

Unit - IV 9 Hours

IoT Architecture and Protocols: Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model. Protocols- 6LowPAN, RPL, CoAP, MQTT.

Case studies / applications.

9 Hours

Unit - V

Device Discovery Management: Device Discovery capabilities – Registering a device, De-register a device.

Cloud Services for IoT: Introduction to Cloud Storage models and communication APIs Web-Server. Web server for IoT.

Case studies / applications.

Text Books:	
1.	Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 2nd Edition, Elsevier, 2008.
2.	ArshdeepBahga, Vijay Madisetti, "Internet of Things (A Hands-on-Approach)" **,** 1st Edition, VPT, 2014.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Utilize** the functionalities of Microprocessors, Complex Systems, Embedded System and IoT.	**L3**
2.	**Identify and demonstrate** the skill of interfacing sensors and actuators with microcontroller development boards.	**L3**
3.	**Design and develop** software programs using embedded C or python programming languages for IoT applications.	**L3**
4.	**Apply** device discovery and cloud services for IoT applications	**L3**
5.	**Analyze** given Case studies / Applications in IoT.	**L4**

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50** ➢				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Software Project Management

Course Code	**18MCA443**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce an overview of Software Project Management, Project Planning and Evaluation.
2. To impart the knowledge of using critical path and precedence networks to model ideal activity plan.
3. To introduce the notion of Risk Management and Resource Allocation.
4. To explore the requirements for the continual monitoring of projects and contract management.
5. To introduce the factors that influence people's behavior in a project environment and to provide the knowledge of different types of team structures and styles of leadership needed in different situations.

Pre-requisites :

- Software Engineering (18MCA25)

Unit - I — 09 Hours

Software Project Management, Evaluation techniques and Management

Introduction to Software Project Management, Project Evaluation And Programme Management, An Overview Of Project Planning.

Unit - II — 09 Hours

Activity Planning

The Objectives Of Activity Planning, When To Plan, Project Schedules, Projects And Activities, Sequencing And Scheduling Activities, Network Planning Models, Formulating A Network Model, Adding The Time Dimension, The Forward Pass, The Backward Pass, Identifying The Critical Path, Activity Float, Shortening The Project Duration, Identifying Critical Activities, Activity On Arrow Networks.

Unit - III — 09 Hours

Risk Management

Risks, Categories Of Risks, A Framework For Dealing With Risks, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks To The Schedule, Applying The PERT Technique, Monte Carlo Simulation, Critical Chain Concepts. **Resource Allocation-** The Nature Of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting The Cost, Being Specific, Publishing The Resource Schedule, Cost Schedule, Scheduling Sequence.

09 Hours

Unit - IV

Monitoring And Control

Creating The Framework, Collecting The Data, Review, Project Termination Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting The Project Back To Target, Change Control, Software Configuration Management. **Managing Contracts-** Types Of Contract, Stages In Contract Placement, and Typical Terms Of A Contract, Contract Management, and Acceptance.

Unit - V

09 Hours

Managing People In Software Environments

Understanding Behavior, Organizational Behavior-A Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation, The Oldham-Hackman Job Characteristics Model, Stress, Health And Safety. Working In Teams- Becoming A Team, Decision Making, Organization And Team Structures, Coordination Dependencies, Dispersed And Virtual Teams, Communication Genres, Communication Plans, Leadership.

Text Books:	
1.	Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, McGraw Hill Education, 5th Edition.
2.	Walker Royce, Software Project Management- A Unified Framework, Addison-Wesley, 1998, Edition 10

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Utilize** the basic concepts of Software Project Management, Project Planning and Evaluation.	L 3
2.	**Build** activity on node and activity on arrow networks.	L 3
3.	**Outline** the factors related to risk management, **Identify** the resources required for a project and **Build** work plan and resource schedule.	L 3
4.	**Identify** the requirements for the continual monitoring of projects and also **Compare** different types of contracts and plan the evaluation of a proposal or product.	L 3
5.	**Choose** the factors that influence people's behavior in a project management and the characteristics of the various team structures and coordination needs of a project.	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	4
2.	Postgraduates will develop confidence for self education and ability for life-long learning.	10

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Soft Computing

Course Code	**18MCA444**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To impart learning algorithms using neural networks.
2. To explore fuzzy logic to solve real world problems.
3. To impart and analyze fuzzy neuro systems.
4. To familiarize genetic algorithm to solve optimization problems

Pre-requisites :

- Data Structures (18MCA14)
- Discrete Mathematics (18MCA15)

Unit - I 09 Hours

Neural Networks

History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture.

Unit - II 09 Hours

Learning Processes

Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit - III 09 Hours

Fuzzy Logic

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Unit - IV 09 Hours

Operations on Fuzzy Sets

Fuzzy Arithmetic, Fuzzy Logic, Uncertainty based Information Complement, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Information & Uncertainty, Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Unit - V **09 Hours**

Introduction of Neuro-Fuzzy Systems

Architecture of Neuro Fuzzy Networks, Applications of Fuzzy Logic: Medicine, Economics etc. Genetic Algorithms: An Overview, Genetic Algorithms in problem solving, Implementation of Genetic Algorithms

Text Books:	
1.	Anderson, James a., An Introduction to Neural Networks, ISBN: 978-81-203-1351-4,PHI, 2008.
2.	Hertz J. Krogh, R.G. Palmer - Introduction to the Theory of Neural Computation, AddisonWesley, 1991, ISBN: 9780201515602
3.	G.J. Klir& B. Yuan - Fuzzy Sets & Fuzzy Logic, PHI, 2006, ISBN: 978-81-203-1136-7
4.	Melanie Mitchell - An Introduction to Genetic Algorithm, PHI, 2006 ISBN: 9670201785602.
5.	S.N.Sivanandam, S.N Deepa, Principles of Soft Computing, 2nd edition, Wiley India (P) Ltd. 2008

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the fundamental theory and concepts of neural networks and different neural network architectures.	L 3
2.	**Identify and Analyze** appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	L 4
3.	**Apply** the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	L 3
4.	**Examine** the concepts of fuzzy sets, fuzzy rules, reasoning, fuzzy inference systems, and fuzzy logic operations.	L 4
5.	**Analyze** neuro-fuzzy systems **and Apply** genetic algorithm to solve optimization problems.	L 4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will develop confidence for self-education and ability for life-long learning.	**10**
	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50** ➢				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Elective - 3
Information Storage Network

Course Code	**18MCA451**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To comprehend Information Storage characteristics and components.
2. To explain the fundamental constructs of striping, mirroring, and parity, which form the basis for various RAID levels.
3. To explainFibre Channel protocols and how SAN components use them to communicate with each other.
4. To emphasizetheemerging NAS, iSCSI and FCIP technology.
5. To impart the fundamental concepts on securing the Storage Infrastructure.
6. To provide information on managing the Storage Infrastructure.

Pre-requisites :

- Computer Networks (18MCA31)

Unit – I **9 Hours**

Introduction to Information Storage and Data Center Environment

Information Storage – Data, Types of Data, BigData, Information, Storage, Evolution of Storage Architecture, Data Center Infrastructure -Core Elements of a Data Center, Key Requirements for Data Center Elements, Managing a Data Center, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance.

Unit – II **9 Hours**

Data Protection, Fibre Channel Storage Area Networks

Implementation of RAID,RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares, Overview of Fibre Channel, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Switched Fabric Login Types, Zoning, FC SAN Topologies, Intelligent Storage system.

Unit – III **9 Hours**

IP SAN, Network-Attached Storage

iSCSI, FCIP, General-Purpose Servers versus NAS Devices, Benefits of NAS, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance

Unit - IV **9 Hours**

Securing the Storage Infrastructure

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Monitoring the Storage Infrastructure.

Unit - V **9 Hours**

Managing the Storage Infrastructure

Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management.

Text Books:	
1.	G.Somasundaram, AlokShrivastava, Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, EMC Education Services, Wiley Publishing Inc., 2012
2.	G.Somasundaram, AlokShrivastava, "Information Storage and Management", EMC Education Series, Wiley Publishing Inc., 2011.
3.	Robert Spalding, "Storage Networks: The Complete Reference",TataMcGrawHill,Osborne, 2003.
4.	Marc Farley, "Building Storage Networks",TataMcGraw Hill, Osborne. 2001.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** fundamental concepts of Information Storage and Data Center environment.	L 4
2.	**Identify** thefundamental constructs of various RAID, Fibre Channel protocols and SAN components to communicate with each other.	L 3
3.	Understand the **importance** of emerging NAS, iSCSI and FCIP technology.	L 5
4.	**Appraise** the importance and challenges of Information on Securingthe Storage Infrastructure.	L 5
5.	**Identify** the importance and challenges of Information on managing the Storage Infrastructure.	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
3.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Application Development using MVC Frameworks

Course Code	**18MCA452**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	2-0-1	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the Web Applications Frameworks.
2. To provide the knowledge on a number of components available in CodeIgniter that are used to develop solutions that are fast and cost little at the same time
3. To introduce the features of AngularJS for designers to use HTML as the template language and it allows for the extension of HTML's syntax to convey the application's components effortlessly.
4. To provide a guidance on developing web applications professionally
5. To introduce the Web Applications Frameworks.

Pre-requisites :

- Introduction to server-side programming using PHP (18MCA34).

Unit - I — 09 Hours

Introduction to frameworks

Introduction to application frameworks, a history of application frameworks. Components: The future of Web-Application Development. Application Frameworks: basics and benefits of application frameworks. Choosing an application framework.

Unit - II — 09 Hours

Getting Started with CodeIgniter and Learning the Libraries

Downloading and installing CodeIgniter, Introducing Model View Controller (MVC), Autoloading resources Formatting your code—PHP Style Guide, CodeIgniter URLs, CodeIgniter specific files

Introduction to libraries and their usage. Benchmarking Class, Input and Security Class, Email Class, File Uploading Class, Pagination Class, Session Class, Unit testing a class

Unit - III — 09 Hours

Using CodeIgniter for Web Application Development

Form Validation and Database Interaction, User Authentication, Application Security, Building a Large-Scale Application

Unit - IV — 09 Hours

Introducing AngularJS

Introducing AngularJS, Basic AngularJS Directives and Controllers. Unit Testing in AngularJS.

Unit - V **09 Hours**

Using AngularJS for Web Application Development

Forms, Inputs, and Services, All About AngularJS Services, Server Communication Using $http, Working with Filters, Routing Using ngRoute

Text Books:	
1.	Xin Chen, Developing Application Frameworks in .NET APress ©2004
2.	Michael Nash, Java frameworks and components, Accelerate your web application development, Cambridge University Press, June 16, 2003
3.	Adam Griffiths, CodeIgniter 1.7 professional development, Packt publishing 2010
4.	ShyamSeshadri and Brad Green, AngularJS: Up and Running, O'Reilly Media, Inc., 2014

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the benefits and features of the application frameworks	L3
2.	**Develop** MVC web application using PHP, CodeIgniter and library classes.	L3
3.	**Analyze** web applications development with forms, database and security	L4
4.	**Develop** web applications with AngularJS with basic features and advanced features like filters and routing.	L3
5.	**Evaluate** of Unit Testing to test the developed web applications	L5

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	PO4
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	PO5
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	PO6

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Client - Server Computing (Theory)

Course Code	**18MCA453**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives	
1.	To introduce a clear understanding of core aspects of Software Architecture and the need of software architecture
2.	To explore the concepts of middleware architecture design principles, requirements traceability and to insure the system meets crosscutting end-to-end software architectural properties.
3.	To provide an architectural specification and to construct architectures in a teamwork setting with minimal requirements.
4.	To impart the knowledge of software-sizing analysis based on architectural components and requirements analysis.

Pre-requisites :

- Computer Networks (18MCA31).

Unit - I — 09 Hours

Introduction to Client/Server Computing

Introduction to client/Server Computing, What is Client/Server Computing,Benefits of Client/Server Computing, Architecture : Data Access Architecture, Execution Architecture,2Tiered,3Tiered Architecture, HardwareTrends, Software Trends, Evolution of Operating System, N/w Trends,Business Considerations

Unit - II — 09 Hours

Overview of Client server applications

Overview of Client serverapplications ,components of Client serverapplications, classes of Client serverapplications, Understanding Client server: Dispelling the Myths, Obstacles-Upfront and Hidden, Open Systems and standards, Setting Organizations, Factors of Success.

Unit - III — 09 Hours

The Client :The Client Hardware and Software

Client Component, Client Operating Systems, what is GUI, Database Access, Client Software products: GUI Environments, Converting 3270/5250 screens,Database tools. Client Requirements : GUI Design standards: Open GUIstandards, Interface ver interface independence, Testing interfaces

Unit - IV — 09 Hours

The Server

Categories of servers, Features of Server machines, Classes of server machines. Server Environment : N/W management environment, N/W Computing Environment, Extentions Network operating system, Loadable module.

Unit - V **09 Hours**

Server operating System and Server requirements

Server operating System: OS/22.0, Windows New Technology, Unix based Operating Systems. Server requirements: Platform independence, Transaction Processing, Connectivity, Intelligent database, Stored Procedure, Triggers, Load leveling, Optimizer and Testing and diagnostic tools- Backup and recovery mechanisms.

Text Books:	
1.	Patrick Smith &SteaveGuengrich " Client Server computing" PHI 2nd edition
2.	Dawn Travis Devire "Client Server computing" TMH 2nd edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the significance of middleware architecture design principles	L3
2.	**Identify** and compose design patterns	L3
3.	**Analyze** the requirements traceability and to insure the system meets cross-cutting end-to-end software architectural properties	L4
4.	**Compare** architectural styles including distributed computing, service-oriented architectures, database-centric architectures, web architectures, email and AI architectures.	L4
5.	**Build** existing systems and then extend them with new capabilities using concepts from architecture description languages.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	PO2
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	PO4
3.	Postgraduates will demonstrate an ability toanalyze and build computer applications for multiple domains	PO5

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Digital Marketing

Course Code	**18MCA454**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide a knowledge on web marketing strategies and best practices.
2. To emphasis the concepts of web marketing.
3. To understand web marketing goals, assigning resources and assessing growth opportunities.
4. To assess how the internet can be used in different marketing functions.

Pre-requisites : --

Unit - I 09 Hours

Introduction to digital marketing

Definitions – what is digital marketing and multi channel marketing, introduction to key features of digital marketing strategy, Applications and benefits of Digital Marketing, Alternative digital business models, Different forms of online presence, Applying the 7Ss, RACE (Reach Act (interact)-Convert-Engage. Digital Marketing communications. Digital media channels and its benefits.

Unit - II 09 Hours

Digital marketing implementation and practice

A short introduction to internet technology, infrastructure components of the Internet, Web Application frameworks and application servers. Digital Security, Approaches for developing secure systems, assessing the marketing value of technology innovation. How to structure a digital marketing strategy, SWOT and SMART. Setting up of SMART objectives, impact of digital media and technology on the marketing mix.

Unit - III 09 Hours

Concepts of digital marketing

Search engines and types of search engines – meta, crawler, directories; Affiliate Marketing, Introduction to Search Engines: Working of a semantic search engine, Google guidelines, Best Practices, Quality guidelines, Design guidelines; Search engine page results – familiarizing Google results. How Google works: Search engine ranking methods, Techniques to get on top of Google, Meta tags best practices

Unit - IV **09 Hours**

Introduction to Search Engine Marketing (SEM) Platforms-paid platforms

What is SEO (Search engine optimization), Growth of SEO in the recent Years, Advantages and disadvantages of SEO, Best practices in planning and managing SEO, On page and off page optimization marketing, Online public relations (e-PR) online PR activities, Differences between online PR and traditional PR. Online partnership, Email Marketing, email marketing used for customer acquisition, prospect conversion andcustomer retention, Offline promotion techniques.

Unit - V **09 Hours**

Online Advertisements

How online ads work Measures used for setting campaign objectives. Step 0 to step 6 (Volume, quality, CPC, CPA, ROI, Branding, lifetime value), PPC (Pay per Click) Digital Marketing Management: Role of web marketing manager, Web marketing department structure, Roles and responsibilities. Digital Marketing Plan: Goals, objectives, KPI‘s,Online Reputation Management: Brand management, Tools to monitor online brand reputation, A/B testing, Landing page creation and optimization Yahoo news.

Case Studies

1. Makemytrip's #DilHaiHindustani campaign.
2. BOO-HOO learning from the largest European dot-com.
3. Alibaba provides a global market for all.
4. Location based Marketing.
5. Dell gets closer to its customers through social media strategy.

Text Books:	
1.	Dave Chaffey and Fiona Ellis-Chandwick, Digital Marketing, 6th edition, Pearson, 2016.
2.	Dave Chaffey, Fiona Ellis-Chandwick, Kevin Johnston and Richard Mayer, Internet Marketing , 3rd Edition, Pearson , 2009

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom’s Level
1.	**Assess** the impact of digital technology on the practice of marketing.	L 5
2.	**Analyze** the use of different forms of digital marketing in the development of an online presence.	L 4
3.	**Choose** a publishing platform to build a web presence with integrated data collection and links to social media.	L 3
4.	**Develop** a plan for marketing a product of business online.	L 3
5.	**Apply** social media tools into a marketing communications strategy.	L 3

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2.	Postgraduates will develop confidence for self-education and ability for life-long learning.	**10**
	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Lecture**
2. **Power-Point Presentation**	2. **Power-Point Presentation**
3. **Videos**	3. **Videos**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Algorithms Laboratory

Course Code	**18MCA46**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To make the students understand the application of various algorithms, design strategies to solve real-life problems like searching, sorting, string processing, graph problems, combinatorial problems, geometric problems and numerical problems
2. To help the students explore the capability to analyze the efficiency of the algorithm, compare and comments on the behavior of the algorithm, and appreciate the working of an algorithm
3. To assist the students find the means to develop analytical skills and problem-solving skills

Pre-requisites :

- Analysis and Design of algorithms(18MCA41)

List of experiments

Minimum 08 experiments can be framed on the following topics

1. Recursion
2. Divide and conquer
3. Decrease and Conquer
4. Dynamic Programming
5. Backtracking
6. String matching
7. Greedy Technique

Books	
1.	AnanyLevitin: "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2007.
2.	Ellis Horowitz, SartajSahni, SanguthevarRajasekaran: "Fundamentals of Computer Algorithms" , 2nd Edition, Universities Press, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify and then choose** the fundamentals of algorithmic problem solving technique.	L3
2. **Explain** and **analyze** any given problem to derive at a best solution	L4
3. **Apply** algorithmic strategies on different problems	L3
4. **Assess** a given problem and derive at a solution by writing an efficient algorithm	L6

Program Outcome of this course (POs)		PO No.
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

Program Specific Outcomes (PSOs)		PSO. No.
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	**1**
2.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success. [PSO 2]	**2**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

J2EE Laboratory

Course Code	**18MCA47**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To impart the importance of Java and Advanced Java technologies.
2. To realize the importance of distributed applications using advanced server side programming like JSP, servlets, and Java beans.
3. To describe the need and importance of IDE to write, debug and execute servlets, server pages, and EJB applications.
4. To explore how to develop of real time secure enterprise applications for any business logic.

Pre-requisites :

- Programming using J2EE (18MCA42)

List of experiments

Minimum 8 experiments can be framed on the following topics

1. Servlet life Cycle and handling data (Get () and Post() methods)from client(Client request)
2. Servlet HTTP request Header
3. Servlet cookies
4. JSP Scripting tags
5. All attributes of JSP Page directive tag, include directive tag
6. JSP Action tags(JSP: include, JSP: forward),
7. JSP application Using Java Bean class
8. JDBC(Java Database Connectivity with different Statement objects) – in console/JSP/Servlet,
9. EJB Application with session Bean.

Books	
1.	Marty Hall, Larry Brown. Core Servlets and Java Server Pages. Volume 1: Core Technologies. Second Edition
2.	Herbert Schildt, Java The Complete Reference, Eight Edition. Comprehensive coverage of the Java Language. Tata McGraw-Hill Edition – 2011
3.	Andrew LeeRubinger, Bill Burke. Developing Enterprise Java Components. Enterprise JavaBeans 3.1.O'reilly
4.	Java 6 Programming Black Book, Dreamtech Press. 2012
5.	Web Technologies: HTML, Javascript,XML and , PHP, Java, JSP, ASP.net, Ajax Black Book Kogent learning Solutions Inc/Wiley India 2008

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Design and build WEB** Applications using advanced Java technologies like JSP and servlets .	**L3**
2.	**Build** Data base applications in Java using any database such as MySQL , Oracle etc**.**	**L6**
3.	**Develop** EJB applications using different enterprise Java beans.	**L6**

Program Outcome of this course (POs)		**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

Program Specific Outcomes (PSOs)		**PSO. No.**
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	**1**
2.	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	**3**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Big Data Laboratory

Course Code	**18MCA48**	**Credits**	01
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To explore HDFS commands
2. To emphasize the applications using MapReduce framework
3. To introduce the programming tools Pig & Hive in Hadoop echo system.

Pre-requisites :

- Introduction to Big Data Paradigm (18MCA43)

List of experiments

Minimum 08 experiments can be framed on the following topics

1. HDFS: review the commands available under HDFS.
2. File operations and directory listing.
3. Display the contents, Create a directory, delete the directory.
4. Map Reduce: to create a job.
5. Tracking a job and terminating a job.
6. Hive commands.
7. Data analysis using Tableau

Books	
1.	DT Editorial Services Big Data – Black Book Dreamtech Press, Edition – 2015, ISBN -978-93-5119-931-1.
2.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis,Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Design** the fundamentals of data analytics techniques and platform available.	**L 3**
2.	**Design** and **Apply** data analytics basic concepts to solve various problems.	**L 3**
3.	**Analyze** the results of data analytics using Map Reduce concepts for various problems	**L 4**
4.	**Evaluate** the solutions of data analytics Hive commands	**L 5**

Program Outcome of this course (POs)		PO No.
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.	3
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	5
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	6

Program Specific Outcomes (PSOs)		PO. No.
1.	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	**1**
2.	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver quality applications for business success. [PSO 2]	**2**

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum Marks:50	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Communicative English

Course Code	**18MCA49**	**Credits**	01
Course type	HS	**CIE Marks**	50 marks
Hours/week: L-T-P	1-0-0	**SEE Marks**	--
Total Hours:	Lecture = 28Hrs; Tutorial = 0 Hrs Total = 28Hrs	**SEE Duration**	--

Course learning objectives

1. To assist the students in developing necessary language skills in the areas like vocabulary, grammar, presentation and interactive communication.
2. To enable them to express their ideas coherently.
3. To help to comprehend and write effectively.
4. To aid them in understanding the importance of Verbal and Non-verbal Communication.

Pre-requisites

- Basic knowledge of English Language.
- Conversant with Basic English Grammar.

Unit - I — 05 Hours

Grammar and Vocabulary

1. Frame grammatically acceptable sentences using Articles, Prepositions, Tenses, Modals and Subject-Verb agreement.
2. Enhance vocabulary with idioms and phrasal verbs.
3. Improve their vocabulary by reading.

Unit - II — 05 Hours

Reading Skills

1. Comprehend and interpret the texts (passages, charts etc).
2. Use work place / business vocabulary.
3. Solve reading assignments from www.cambridgeenglish.org

Unit - III — 05 Hours

Listening Skills

1. Interpret recorded audio-video scripts.
2. Make use of words and phrases related to people and the world.
3. Solve listening exercises from www.cambridgeenglish.org.

Unit - IV — 08 Hours

Speaking Skills

1. Interact effectively as an individual and also as a member in a team.
2. Design and formulate presentations.

Unit - V — 05 Hours

Writing Skills

1. Write informative, analytical and persuasive essays.
2. Write emails, memos and letters for formal communication.

Text Books:	
1.	Norman Whitby, "Cambridge English Business Benchmark", Cambridge University Press, 3rd Printing 2014.
2.	T. M. Farhathulla, "Communication Skills for Undergraduates" - RBA-Chennai, 2006.
3.	K.R. Lakshminarayanan, "English for Technical Communication", Scitech-Chennai, 2002.
4.	Prof. G.S. Mudambadithya, "Functional English", Sapana- Bangalore,
5.	Prof. M.B. Kudari, "Passage to English" Self Publication, Gokak, 2011.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Experiment with** various grammatical concepts such as Articles, Prepositions, Subject-Verb Agreement, and Tenses in the use of English language.	L3
2.	**Interpret** the given information or data in the form of reading or listening materials.	L3
3.	**Distinguish** among the various grammatical concepts like sentence patterns, sub-verb agreement, tenses etc.	L4
4.	**Evaluate** the grammatically acceptable sentences, and **Defend** their view-points.	L5
5.	**Design** and **Formulate** oral and written presentations.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will be able to communicate effectively in both verbal and written form	PO8
2.	Postgraduates will develop confidence for self-education and ability for life-long learning	PO10
3.	Postgraduates can participate and succeed in competitive examinations.	PO11

	Course delivery methods		**Assessment methods**
1.	**Lecture**	1.	**Individual speech**
2.	**Learnsoft Software**	2.	**PPT (Group activity)**
3.	**PPT**	3.	**Writing test**
4.	**Vocabulary activities/PPT**	4.	**Online Quiz**

Scheme of Continuous Internal Evaluation (CIE):

Components	Individual activity - Speech	Group Activity – Power Point Presentation	Writing Skills – Essay & Email/memo/report	Class Performance (Attendance)	Online Test	Total
Maximum Marks (50)	5	15	10	5	15	50

ESTD. 1939

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GOGTE INSTITUTE OF TECHNOLOGY
"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
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www.git.edu

ESTD. 1979

2018-19 Scheme

Department: MCA

Programme: MCA

1rd to 6th Semester Scheme of Teaching and Examination

5th and 6th Semester Syllabus

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

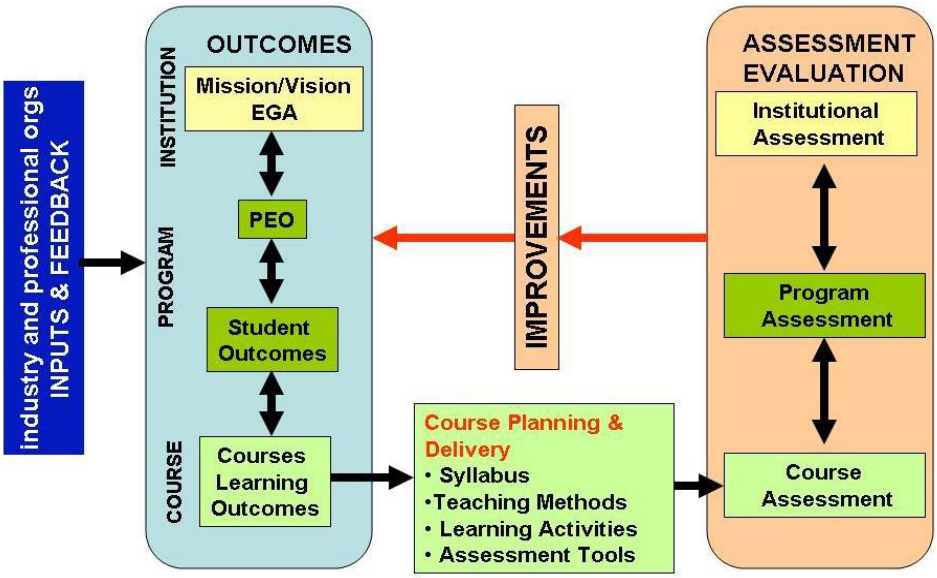
QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
The department of Master of Computer Applications shall strive to stand out as par excellence in generating and grooming, technically competent and skilled intellectual professionals to meet the challenges of the modern computing industry.

MISSION
To train the graduates to become IT professionals having strong fundamental knowledge in the field of computer application with ethical values to meet increasing global challenges of ever evolving technologies.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs) :

1. Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.
2. Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.
6. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.
7. Postgraduates will demonstrate knowledge of professional and ethical responsibilities.
8. Postgraduates will be able to communicate effectively in both verbal and written form.
9. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional.
10. Postgraduates will develop confidence for self-education and ability for life-long learning.
11. Postgraduates can participate and succeed in competitive examinations.
12. Postgraduates will use research-based knowledge and research methods including design of experiments,analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Real Life Problem Solving: Postgraduates of the programme will develop solutions to the real world problems by developing computer applications using the knowledge of mathematics, computer science and engineering in the diverse field of Information Technology.

PEO2: High-Quality Computer Professionals: The postgraduates shall practice and grow as computer professionals by conducting research, design, develop, test and maintain projects in varied fields of computer science and engineering using the state-of-the-art tools and technologies.

PEO3: Leadership Skills: The postgraduates will exhibit their leadership skills with ethics, integrity, competency and social responsibility.

PEO4: Lifelong Learning: The postgraduates shall always stand out of the crowd by enhancing their abilities in their profession through lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **PSO1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

2. PSO2: Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality application for business success.

3.PSO3: Successful Career and Entrepreneurship: The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

PROGRAM SPECIFIC CRITERIA (PSCs):

PSC 1: Apply the knowledge of mathematics, computing and management through critical thinking in addressing the real time problems.

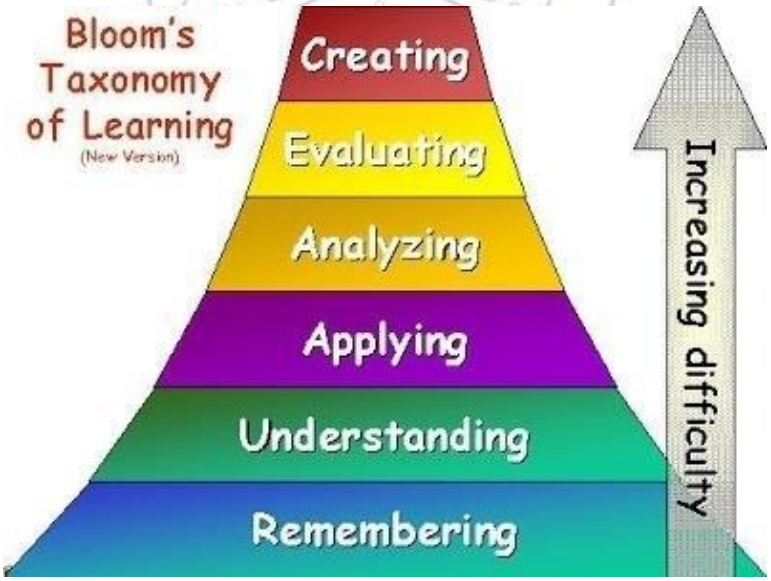
PSC 2: To design, analyze, model and realize physical systems, components or processes using modern software tools and technologies.

PSC 3: Prepare students to work professionally in multidisciplinary environments.

BLOOM'STAXONOMYOFLEARNINGOBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills(LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills(HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination -1st to 6thSemesterMCA

As per the guidelines of UGC CBCS the courses can be classified into:

(i) Core Courses (PC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

(ii) Foundation Courses: The Foundation Courses are of two kinds:

Compulsory Foundation: These courses are the courses based upon the content that leads to Knowledge enhancement.These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in

technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

(iv) Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining MCA Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for MCA program

Total credits for MCA Program: credits

		Regular batch		**Lateral entry**	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	23	44	--	--
	2	21		--	
2nd year	3	22	44	22	44
	4	22		22	
3rd year	5	21	44	21	44
	6	23		23	
	Total	**132**	**132**	**88**	**88**

Credit definition:

Lecture (L):One Hour /week – 1 credit

Tutorial (T): Two hour /week – 1 credit

Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination -1st to 6th SemesterMCA

I Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA11	UNIX and Shell Programming	CF	4-0-0	4	4	50	50	100
2	18MCA12	Web Programming	CF	4-0-0	4	4	50	50	100
3	18MCA13	Digital Systems and Computer Organization	CC	4-0-0	4	4	50	50	100
4	18MCA14	Data Structures	CC	4-0-0	4	4	50	50	100
5	18MCA15	Discrete Mathematics	CC	4-0-0	4	4	50	50	100
7	18MCA16	UNIX & Shell Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA17	Web Programming Laboratory	CC	0-0-2	2	1	50	50	100
9	18MCA18	Data Structures Laboratory	CC	0-0-2	2	1	50	50	100
			Total	**20-0-6**	**26**	**23**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:**Compulsory Foundation

II Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA21	Programming using Java	CC	4-0-0	4	4	50	50	100
2	18MCA22	Database Management Systems	CF	4-0-0	4	4	50	50	100
3	18MCA23	Operating Systems	CC	4-0-0	4	4	50	50	100
4	18MCA24	Computing for Data Analytics	CC	3-0-0	3	3	50	50	100
5	18MCA25	Software Engineering	CC	3-0-0	3	3	50	50	100
6	18MCA26	Java ProgrammingLaboratory	CC	0-0-2	2	1	50	50	100
7	18MCA27	Database Management Systems Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA28	Software Engineering & Testing Lab	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:**Compulsory Foundation

III Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA31	Computer Networks	CF	4-0-0	4	4	50	50	100
2	18MCA32	Python Programming	CC	4-0-0	4	4	50	50	100
3	18MCA33	Cloud Computing	CC	4-0-0	4	4	50	50	100
4	18MCA34	Introduction to server-side programming using PHP	CC	4-0-0	4	4	50	50	100
5	18MCA35X	Elective – 1	FE	3-0-0	3	3	50	50	100
6	18MCA36	Computer Networks Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA37	Python Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA38	PHP Programming Laboratory	CC	0-0-2	2	1	50	50	100
Total				**19-0-6**	**25**	**22**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective

Certification Courses: 2-credits

- Two certifications are compulsory and need to be completed before start of 6th semester.
- Choose certifications, which have industrial acceptance.
- Students have to submit the certificates with valid score of the certifications they have completed to the department during 6th semester. **This is mandatory for the award of the credits and degree.**
- These certifications are evaluated by a panel formed at college level during 6th semester for the award of 2 credits.

Elective Group

Note: Students are advised to select any one subject from the following elective group for Elective-1

Elective Group-1

Sl. No.	Course Code	Course Title
1	351	System Software
2	352	Linux Administration
3	353	Enterprise Resource Planning
4	354	Object Oriented Modelling and Design patterns

IV Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/ Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA41	Anlysis and Design of Algorithms	CC	4-0-0	4	4	50	50	100
2	18MCA42	Programming Using J2EE	CC	4-0-0	4	4	50	50	100
3	18MCA43	Introduction to Big Data paradigm	CC	4-0-0	4	4	50	50	100
4	18MCA44X	Elective – 2	GE	3-0-0	3	3	50	50	100
5	18MCA45X	Elective – 3	GE	3-0-0	3	3	50	50	100
6	18MCA46	Algorithms Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA47	J2EE Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA48	Big Data Laboratory	CC	0-0-2	2	1	50	50	100
9	18MCA49	Communicative English	CF	1-0-0	2	1	50	--	50
			Total	**19-0-6**	**25**	**22**	**450**	**400**	**850**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **CF:** Compulsory Foundation **FE:**Foundation Elective**GE:** Generic Elective.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-2 and Elective-3 respectively.

Elective Group-2

Sl. No.	Course Code	Course Title
1	441	Advanced Database Management System
2	442	Internet Of Things
3	443	Software Project Management
4	444	Soft Computing

Elective Group-3

Sl. No.	Course Code	Course Title
1	451	Information Storage Network
2	452	Application Development using MVC Frameworks
3	453	Client-Server Computing
4	454	Digital Marketing

V Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/ Week	Credits	CIE Marks	SEE Marks	Total Marks
1	18MCA51	Mobile Application Development	CC	4-0-0	4	4	50	50	100
2	18MCA52	.NET Programming using c#	CC	4-0-0	4	4	50	50	100
3	18MCA53	Machine Learning	CC	4-0-0	4	4	50	50	100
4	18MCA54X	Elective – 4	GE	3-0-0	3	3	50	50	100
5	18MCA55X	Elective – 5	GE	3-0-0	3	3	50	50	100
6	18MCA56	Mobile Application Laboratory	CC	0-0-2	2	1	50	50	100
7	18MCA57	C# Programming Laboratory	CC	0-0-2	2	1	50	50	100
8	18MCA58	Project Work-1	CC	0-0-2	2	1	50	50	100
			Total	**18-0-6**	**24**	**21**	**400**	**400**	**800**

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Core Course **GE:** Generic Elective

Recommended to publish paper of Mini project work in any reputed journals like IEEE/ Springer/Elsevier (Science Direct)/Scopus/DBLP indexed conference etc.

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-4 and Elective-5 respectively.

Elective Group- 4

Sl. No.	Course Code	Course Title
1	541	Advanced Computer Networks
2	542	Cyber Security and cyber Laws
3	543	Blockchain
4	544	Services Oriented Architecture

Elective Group- 5

Sl. No.	Course Code	Course Title
1	551	Web 3.0 and Rich Internet Applications
2	552	Information Retrieval
3	553	NoSQL
4	554	Wireless and Mobile Computing

VI Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks		Total Marks
								Demonstration, Presentation and Viva	Dissertation	
1	18MCA61	Internship	CC	NA	Full Time	4	50	--	--	50
2	18MCA62	Project Work-2	CC	NA	Full Time	15	50	100	50	200
3	18MCA63	Seminar	SC	NA	2	2	50	-	-	50
3	18MCA64	Certification-1 (Cambridge Certification)	CC	NA	1	1	--	--	--	--
4	18MCA65	Certification-2 (Technical Certification)	CC	NA	1	1	--	--	--	--
			Total	NA	--	23	150	100	50	300

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Compulsory Core **SC:** Seminar Component **NA:** Not Applicable

18MCA64 and 18MCA65: Certification Courses

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Mobile Application Development (Theory)

Course Code	**18MCA51**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To emphasize on the basic concepts to designing android applications.
2. To introduce the basics of UI designing, event handling mechanisms, menus, activities required to develop android mobile applications.
3. To provide the knowledge of handling user data using SQLite and firebase.
4. To introduce ionic framework used in developing android applications.

Pre-requisites :

- Web Programming (18MCA12)
- Programming using Java (18MCA21)

Unit – I 12 Hours

Introduction to Android Studio and Android

Setting up android studio development environment, creating an example android app in android studio, creating an android virtual device (AVD) in android studio, using and configuring the android studio AVD emulator, testing android studio apps on a physical android device, an overview of the android architecture, the anatomy of an android application

Unit – II 10 Hours

Activity, UI Designing and Event Handling

Understanding android application and activity life cycles, handling android activity state changes, saving and restoring the state of an android activity, understanding android views, view groups and layouts, an overview and example of android event handling

Unit – III 10 Hours

Menus, RecyclerView and Intents

Creating and managing overflow menus on android, working with the recyclerview and cardview widgets, , an overview of android intents, android explicit intents – a worked example, android implicit intents – a worked example.

Unit – IV 10 Hours

Working with SQLite Database and Introduction to Ionic Framework

An overview of android SQLite databases, an android SQLite database tutorial creating our first app with ionic, managing states and navigation

Unit – V 10 Hours

Handling Device features and data in Ionic

Adding device features support, offline data storage, handling gestures and events, saving and loading data using firebase.

Text Books	
1.	Neil Smyth, Android Studio 3.0 Development Essentials Android 8 Edition, Payload Media, Inc. 2017.
2.	Hoc Phan, Ionic Cookbook,Packt Publishing Ltd, 2015.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Experiment with** the android architecture and the anatomy of an android application	L3
2.	**Experiment with** different avd in android studio and testing apps on physical device.	L3
3.	**Construct** android apps with activities, views, groups, event handling, menus, intents, recyclerview and widgets	L3
4.	**Decide** applications development with SQLite databases, offline data storage, handling gestures and events	L5
5.	**Design** and develop applications on Ionic and firebase.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	**4**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**

3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

.NET Programming using C# (Theory)

Course Code	**18MCA52**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52Hrs; Tutorial = 0 Hrs Total = 52Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce .NET platform's core aspects with applications development approach.
2. To focus on real time usage of Object-Oriented features using C# programming language.
3. To emphasize on ADO.NET services to achieve data communication with linear and non-linear database systems.
4. To introduce ASP.NET services for developing dynamic web applications.

Pre-requisites :

- Programming using JAVA (18MCA21)

Unit – I 12 Hours

Introduction to .NET Framework and C# 5.0

Benefits of .NET framework, architecture of .NET framework. C# preprocessor directives, simple console application, identifiers, keywords, data types, variables and constants. Expressions and operators, Checked and unchecked statements.

Unit – II 10 Hours

Object Oriented Programming using C#

Namespaces, the system namespace, classes and objects, constructors and destructors, static classes and static class members, properties, indexers, structs. Encapsulation, inheritance, polymorphism, abstraction, interfaces.

Unit – III 10 Hours

Data Access with ADO.NET

Understanding ADO.NET, typed vs untyped dataset, data reader, creating connection string, creating connection to a database SQL, OLEDB's and ODBC, creating SQL command object, working with data adapter. Using data reader to work with database.

Unit – IV 10 Hours

Web Development using ASP.NET

Specifying a location for a web application, file types in ASP.NET4.5, exploring ASP.NET4.5 web pages, code render blocks, ASP.NET4.5 page directive, web forms: standard controls – the label control, the button control, the textbox control, the literal control, the placeholder control, the hidden filed control, the file upload control, the image control, the image button control, the list box control, the drop down list control, the check box control, the radio button control, the table control.

Unit – V **10 Hours**

Validation Control and Master Pages

Unobtrusive validation in ASP.NET web forms, the base validator class, the required file validator control, the range validator control, the regular expression validator control, the compare validator control, the custom validator control. Understanding the need for master pages and themes, understanding Master page, creating master pages, configuring master pages, loading master pages dynamically.

Text Books	
1.	.NET4.5 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiely-Dream Tech Press
2.	Anne Boehm, Joel Murach, Murach's ASP.NET 4 web programming with C# 2010, Mike Murach& Associates Inc.; 4th edition4th Edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Make use of** various components of .NET framework	L3
2.	**Apply** object oriented features using C# for developing applications.	L3
3.	**Analyze**the ADO.NET service providers to choose appropriate database and establish database connectivity.	L4
4.	**Assess** various concepts of ASP.NET and choose as per requirement specification	L5
5.	**Build** dynamic and rich applications with consistent look and authentic validations using validation control and master pages.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	**4**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Machine Learning (Theory)

Course Code	**18MCA53**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 52 Hrs; Tutorial = 0 Hrs Total = 52 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the concept of machine learning.
2. To present various machine learning algorithms like classification, clustering, neural networks and their applications.
3. To elaborate the implementation of various machine learning techniques.
4. To explore the extraction of hidden information, patterns from large data repository.

Pre-requisites : Computing for Data Analytics (18MCA24)

Unit – I — 12 Hours

Introduction and concept learning

Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept learning task, Concept learning as search, Find-S algorithm,

Data Mining

Introduction, Data Mining tasks, Data Preprocessing, Measures of Similarity and Dissimilarity

Unit – II — 10 Hours

Decision Tree Learning

Basics, General Approach to Solve Classification problem, Decision Tree Induction, Model Over fitting, Evaluating the Performance of Classifier, Rule Based Classifier

Unit – III — 10 Hours

Artificial Neural Networks

Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning , Perceptrons , Multilayer Networks and the Back Propagation Algorithm

Unit – IV — 10 Hours

Bayesian Learning

Introduction, Bayes theorem, Using Bayes Theorem for Classification , Naive Bayes classifier, Bayesian Belief networks

Instance Based Learning

Introduction, Nearest Neighbor Classifiers

Unit – V — 10 Hours

Clustering Techniques

Overview, Types of Cluster Analysis Methods, K-Means, Agglomerative Hierarchical clustering, DBSCAN , Cluster Evaluation

Text Books	
1.	Tom M. Mitchell, Machine Learning**,** India Edition 2013, McGraw Hill Education
2.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, LPE,2014
3.	EthemAlpaydın, Introduction to Machine Learning, second edition, MIT press.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the problems for machine learningand select the either supervised, unsupervised learning or Illustrate the importance of similarity and dissimilarity measures.	L3
2.	**Identify and apply** the decision tree machine learning algorithms for classification in real world domains.	L3
3.	**Make use of** Artificial neural network technique to learn the model for solving real world problems.	L3
4.	**Analyze** Bayesian classifier and k nearest neighbor algorithms.	L4
5.	**Create** clusters on a given data set by implementing the different clustering techniques	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
3.	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	**12**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

2.	**Minimum marks required in SEE to pass: 20**
3.	Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Advanced Computer Networks (Elective)

Course Code	**18MCA541**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45 Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To explore Communication Networks, Network Services and layered Architecture.
2. To emphasize the different Internet protocols.
3. To provide understanding of the ATM and Wireless Networks.

Pre-requisites:

- Computer Networks (18MCA31)
- Computing for Data Analytics (18MCA24)

UNIT-I **9 Hours**

Overview

History of Communication Networks,Networking principles, Future networks.

UNIT-II **9 Hours**

Network Services and Layered Architectures

Applications, Traffic characterization and quality of service, Network services, High performance networks, Network Elements, Basic Network Mechanisms, Layered Architecture, Open data network model, Network architectures, Network bottlenecks.

UNIT-III **9 Hours**

The Internet and TCP/IP Networks

The Internet,Overview of Internet Protocols, Internet Protocol, TCP and UDP, Internet success and limitation, Performance of TCP/IP Networks.

UNIT-IV **9 Hours**

Circuit-Switched Networks and Asynchronous Transfer Mode

SONET, Dense Wave-Division Multiplexing, Fiber to the Home.

Main features of ATM, Addressing, signaling and Routing, ATM header structure, ATM Adaptation Layer.

UNIT-V **9 Hours**

Wireless Networks and Introduction to Internet of Things

The Wireless Channel, Link Level Design, Channel Access, Network Design, Wireless Networks Today, Future Systemsand Standards.

Internet of Things Common Definition, IoT Strategic Research and Innovation Directions, IoT Smart-X Applications, Internet of Things and related future internet technologies, Network and Communication.

Text Books	
1.	High-Performance Communication Networks by Walrand and Pravin Varaiya: Morgan Kauffman/ Elsivier, 2nd Edition-2000.
2.	High-Speed Networks and Internet: Performance and Quality of service by William Stallings, Pearson Edu., 2001.
3.	High Performance TCP/IP: Networking Concepts, Issues, and Solutions, Mahbub Hassan and Raj Jain, IST Edition, 2009 PHI Learning
4.	TCP/IP Illustrated (Volume I, Volume II and Volume III), W. Richard Stevens, Addison-Wesley.
5.	OvidiuVermesan, Peter Friess, IoT from Research and Innovation to Market Development, River Publisher 2014.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** and **classify** the communication networks principles and future networks.	L 4
2.	**Summarize** the network services and layered architectures.	L 3
3.	**Analyze** the Internet and different protocols.	L 4
4.	**Assess** the circuit switched networks and ATM.	L 5
5.	**Appraise** the wireless networks and concept of IoT and its applications.	L 5

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Post graduates will demonstrate an ability to design a system, component or process as per needs and specifications.	**4**
3.	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**12**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Average of best two IA tests out of three**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions selecting at least one full question from each unit.

Cyber Security and Cyber Laws (Theory)

Course Code	**18MCA542**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45 Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the concept of cybercrime and cyber offenses.
2. To emphasize on security challenges of mobile devices and organizational measures to handle such threats.
3. To explore the tools and methods used in cybercrime.
4. To elaborate on the legal perspectives of cybercrimes in India.
5. To introduce the concept of Computer forensics.

Pre-requisites :

- Computer Networks (18MCA31)

Unit – I 10 Hours

Introduction to Cybercrime

Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes; Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000; A Global Perspective on Cybercrimes.

Cyberoffenses: How Criminals Plan Them

Introduction; How Criminals Plan the Attacks; Social Engineering; Cyberstalking; Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit – II 10 Hours

Cybercrime: Mobile and Wireless devices

Proliferation of Mobile and Wireless Devices; Trends in Mobility, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication Service Security; Attacks on Mobile/Cell phones; Mobile Devices: Security implications for organizations; Organizational measures for handling mobile devices-related security issues; Organizational security policies and measures in mobile computing era.

Phishing and Identity Theft

Introduction; Phishing; Identity theft.

Unit – III 9 Hours

Tools and Methods Used in Cybercrime

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit – IV **8 Hours**

The Legal Perspectives

Cybercrime and the Legal Landscape around the World, Why Do We Need Cyberlaws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.

Unit – V **8 Hours**

Computer Forensics

Understanding Computer Forensics · Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail · Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics. Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics · Special Tools and Techniques, Forensics Auditing · Antiforensics

Text Books	
1.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Nina Godbole, SunitBelapure, Wiley : April 2011 India Publications Released
2.	Computer Forensics and Cyber Crime An Introduction byMarjie T. Britz ,Pearson publication, 2nd edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Interpret** cybercrime, cyber offenses and cybercrimes on mobile and wireless devices.	L 5
2.	**Analyze** Cybercrime in Mobile devices and **Discover** Phishing and Identity theft	L 4
3.	**Make use of** tools and methods used in cybercrime.	L 3
4.	**Recommend** the legal perspectives of cybercrimes.	L 5
5.	**Inspect** the various aspects ofComputer forensics.	L 4

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**
3.	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**12**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**

3. **Video**

3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Blockchain(Theory)

Course Code	18MCA543	Credits	3
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours:	Lecture = 45 Hrs ; Tutorial = 0 ; Total = 45Hrs	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To provide the knowledge of Blockchain Technology, its importance and application of cryptography inblockchain
2. To explore various implementations of Blockchain Technology such as bitcoin, Ethereum, and Hyperledger

Pre-requisites : --

Unit – I 9 Hours

Introduction to Blockchain Technology

Distributed systems, The history of blockchain, Introduction to blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain, Decentralization using blockchain, Methods of decentralization, Routes to decentralization

Unit – II 9 Hours

Cryptography in Blockchain

Introduction, cryptographic primitives, Assymetric cryptography, public and private keys, line interface, Bitcoin improvement proposals (BIPs), Consensus Algorithms.

Unit – III 9 Hours

BitCoin

Introduction, Transactions, Structure, Transactions types, The structure of a block, The genesis block, The bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bitcoins, Bitcoin installation, Bitcoin programming and the command-line interface, Bitcoin improvement proposals (BIPs).

Unit – IV 9 Hours

Ethereum

Ethereumblockchain, Elements of the Ethereumblockchain, Precompiled contracts, Accounts and its types, Block header, Ether, Messages, Mining, Clients and wallets, Trading and investment, The yellow paper, The Ethereum network, Applications developed on Ethereum , Scalability and securityissues.

Unit – V 9 Hours

Smart Contract and Hyperledger

History of Smart Contract, Ricardian contracts, The DAO. Hyperledger project, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda Architecture.

Text Books	
1.	Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and

	smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing,2018.
2.	A. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O'Reilly,2015
3.	Nakul Shah, Blockchain for Business with Hyperledger Fabric, BPB Publications.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **List**the features, types, and benefits of blockchain along with various consensus mechanisms and **Identify** the relationship of decentralization in the context of blockchain Technology.	L4
2. **Analyze**the algorithms related to cryptography with respect to blockchain technology.	L4
3. **Compare** different types of wallets available for bitcoin and **Examine**how the bitcoin protocol works and the types of messages exchanged on the network between nodes, during various node and network operations.	L4
4. **Identify** various components, protocols, and algorithms relevant to the Ethereumblockchain paradigm and applications developed on ethereum.	L3
5. **Examine**Hyperledger project of Linux Foundation for various blockchain projects introduced by its members.	L4

Program Outcome of this course (POs)	PO No.
1. Postgraduates will demonstrate knowledge in mathematics, computer applications and management.	**1**
2. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional	**9**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Services Oriented Architecture

Course Code	**18MCA544**	**Credits**	3
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the step by step processes for service oriented analysis and service oriented design
2. To impart an in depth exploration of service orientation as a distinct design paradigm, including a comparison to object orientation
3. To emphasize on various web services technologies and WS-* specifications
4. To elaborate on the guidelines for service oriented business modeling and the creation of specialized service abstraction layers

Pre-requisites :

- Web Programming(18MCA12)
- **S**oftware Engineering (18MCA25)

Unit – I 9 Hours

Introduction and Evolution of SOA

Fundamentals of SOA, Common characteristics of contemporary SOA, Common Tangible benefits of SOA, The Continuing evolution of SOA (standards organizations and Contributing vendors), The Roots of SOA (comparing SOA to Past Architectures).

Unit – II 9 Hours

Web Services, Primitives of SOA, Contemporary SOA

The Web Services framework, Services (as Web Services), Service Description (with WSDL), Messaging (with SOAP). Message Exchange patterns, Service Activity; Coordination, Atomic Transactions, Business Activities, Orchestration, Choreography.

Unit – III 9 Hours

Web Services and Contemporary SOA

Addressing, Reliable Messaging, Correlation, Policies, Meta data Exchange, Security, Notification and eventing,

Principles of Service – Orientation

Services- Orientation and the enterprise, Anatomy of service-oriented Architecture, Common Principles of Service Orientation; How Service Orientation principles inter relate.

Unit – IV 9 Hours

Service Layers

Service Orientation and contemporary SOA, Service Layer Abstraction, Application service layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration scenarios

9 Hours

Unit – V

Business Process Design

WS-BPEL Language basics, WS-Coordination overview, Service oriented business process redesign

Text Books	
1.	Thomas Erl, Service-Oriented Architecture: Concepts, Technology, and Design, Pearson Education, 2005
2.	Eric Newcomer, Greg Lomow, Understanding SOA with Web Services, Pearson Education, 2005

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** and **Summarise** the common characteristics, tangible benefits, evolution trends of SOA.	L 3
2.	**Identify, Compare** and **Contrast** Web Services, Primitives of SOA, Contemporary SOA	L 4
3.	**Identify and Analyse c**ommon concepts of web service specification, principles of Service – Orientation	L 4
4.	**Organize** and **Examine** specialized service layers around the delivery of key contemporary SOA characteristics.	L 4
5.	**Analyse** the design of orchestration layer by using WS-BPEL Language	L 4

Program Outcome of this course (POs)		**PO No.**
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Web 3.0 and Rich Internet Applications

Course Code	**18MCA551**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45 Hrs; Tutorial = 0 Hrs Total = 45 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide an insight on how semanticweb technology fits in to the past, present, and future evolution of the internet.
2. To clarify the differences between semanticweb technology and existing data-sharing technologies, such as relational databases and the current state of the World Wide Web.
3. To explore the three primary international standards that help define the semantic web.

Pre-requisites

- Web Programming (18MCA12)

Unit – I **9 Hours**

The World of the Semantic Web

From Traditional Web to Semantic Web: What is WWW? How are we using the internet? What stops us from doing more? A first look at the semantic web, an introduction to metadata. The basic concept of metadata, metadata considerations.

Unit – II **9 Hours**

The Nuts and Bolts of Semantic Web Technology

The Building Block of the Semantic Web: RDF overview: what is RDF? The basic elements of RDF, RDF triples: knowledge that machines can use a closer look at RDF, fundamental rules of RDF, aggregation and distributed information.

Unit – III **9 Hours**

RDFS, Taxonomyand Ontology

Overview: why we need RDFS, RDFS + RDF: one more step toward machine-readability, core elements of RDFS, the concepts of ontology and taxonomy, another look at inferencing based on RDF schema.

Unit – IV **9 Hours**

Web Ontology Language (OWL)

Using OWL to define classes: localize global properties, using OWL to define class: set operators and enumeration, using OWL to define properties: a richer syntax for more reasoning power, using OWL to define properties: property characteristics, ontology matching and distributed information, OWL ontology header.

Unit – V **9 Hours**

Validating Your OWL Ontology

Related development tools, validate OWL ontology by using web Utilities, using programming API's to understand OWL ontology. The Semantic Web: Real-World Examples and Applications.

Swoogle: A Search Engine for Semantic Web Documents, a close look inside Swoogle, examples of using Swoogle.

Text Books	
1.	Liyang Yu. Introduction to the Semantic Web and Web Services, Chapman & Hall/CRC, Taylor & Francis Group.
2.	Grigoris Antoniou, Paul Groth, Frank van Harmelen, Rinke Hoekstra. A Semantic Web Primer, The MIT Press, 3rd Edition.
3.	Thoman B. Passin. Explorer's Guide to the Semantic Web. Manning, 2004.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Distinguish** between traditional web and semantic web.	L 4
2. **Identify** the primary international standards of the semantic web.	L 3
3. **Examine** the concept RDFS, ontology and taxonomy.	L 4
4. **Make use of** OWL to define classes, enumerations and properties.	L 3
5. **Identify** tools to validate OWL.	L 3

Program Outcome of this course (POs)	**PO No.**
1. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
2. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Information Retrieval

Course Code	**18MCA552**	**Credits**	3
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To provide clear understanding of retrieval strategies
2. To provide knowledge about relationship between information retrieval, hypermedia architectures, and semantic models
3. To explore important retrieval models such as vector space, Boolean and query expansion.
4. To provide clear understanding cross language information retrieval
5. To acquire knowledge about platforms to implement comprehensive catalogue of information search tools

Pre-requisites:

- Database Management Systems (18MCA22)
- Computing for Data Analytics(18MCA24)

Unit – I 9 Hours

Introduction, Retrieval strategies

vector space model, Probabilistic retrieval strategies, some more retrieval strategies: language models; inference networks; extended Boolean retrieval; Latent semantic indexing

Unit – II 7 Hours

Retrieval Utilities

Relevance feedback clustering; passage based retrieval; N-grams, Regression analysis; Thesauri; semantic networks; parsing

Unit – III 9 Hours

Indexing and searching

Introduction, inverted files, other indices for text, Boolean queries, sequential searching, pattern matching, structural queries, compression

Unit – IV 9 Hours

Cross – language information retrieval and efficiency

Introduction, crossing the language barrier, cross language retrieval strategies, cross language utilities, duplicate document detection

Unit – V 11 Hours

Integrating structured data and text

Reviewof the rational model, a historical progression, information retrieval as a relational application, semi structured search using relational schema, multidimensional data model

Parallel information retrieval

Parallel text scanning, Parallel indexing, clustering and classification, large parallel systems

Text Books	
1.	David A. Grossman, Ophir Friedberg, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press)
2.	Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** information retrieval strategies	L 3
2.	**Compare** N-grams, Regression analysis	L 4
3.	**Identify and Analyse** inverted files, Boolean queries and sequential search	L 4
4.	**Analyze** cross language information retrieval strategies	L 4
5.	**Identify** semi structured search using rational schema and multidimensional data model. **Apply** clustering and classification techniques for data retrieval	L 3

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems	**2**
2.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
3	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**12**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting one full question from each unit.

NoSQL

Course Code	**18MCA553**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours

Course learning objectives

1. To introduce the concepts of big data and need of NoSQL.
2. To provide different flavors of NoSQL like MongoDB,HBase, Cassandra.
3. To explore accessing the data using cloud, implement MapReduce to store using Hive, the big data using Apache Pig high level language
4. To give an insight in to the designing, storing and accessing the big data using NoSQL
5. To emphasize on the designing and developing web application using NoSQL
6. To expose the administrative tasks and implementing administration of NoSQL while maintaining the web applications

Pre-requisites:

- Database Management System(18MCA22).

Unit – I 9 Hours

Introduction to NoSQL

Definition of NoSQL, History of NoSQL and Different NoSQL products, Exploring MondoDB Java/Ruby/Python, NoSQL Storage Architecture

Unit – II 9 Hours

NoSQL Basics

CRUD operations with MongoDB and HBase, Querying, Modifying and Managing NoSQL Data stores, Indexing and ordering datasets (MongoDB)

Unit – III 9 Hours

Advanced NoSQL and NoSQL Administration

NoSQL in CLOUD, Parallel Processing with Map Reduce, BigData with Hive, NoSQL Database Administration

Unit – IV 9 Hours

Database Internals and Cassandra

Surveying Database Internals, migrating from RDBMS to NoSQL, the Cassandra Data Model, Reading and Writing Data: Query Basic write properties, basic read properties, and Deleting data.

Unit – V 9 Hours

Developing Web Application with NoSQL

PHPandMongoDB,Creating A Blog Application with PHP driver

	Text Books
1.	"Professional NOSQL" Shashank Tiwari, 2011, WROX Press.
2.	Cassandra: The Definitive Guide, Eben Hewitt, O'Reilly
3.	The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010

Course Outcome (COs)

	At the end of the course, the student will be able to	Bloom's Level
1.	**Identify** the limitations of RDBMs, need of NoSQL for Big Data, different NoSQL products with their storage architecture.	**L3**
2.	**Apply** CRUD operations with MongoDB and HBase, storing, indexing data and accessing data with MongoDB.	**L 3**
3.	**Construct** MapReduce –parallel programming model with Hive for distributed processing on large data sets, on a cluster of computers	**L 3**
4.	**Explain** MongoDB internals and Cassandra operations.	**L 5**
5.	**Develop** Web applications using NoSQL with PHP	**L 6**

	Program Outcome of course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Video**	3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Wireless and Mobile Computing (Elective)

Course Code	**18MCA554**	**Credits**	03
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0 Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To inculcate knowledge of Mobile Computing, Mobile Computing Architecture, and Mobile Computing Environment.
2. To describe the various technologies like Global System for Mobile Communication (GSM), Short Message Service (SMS), General Packet Radio Service (GPRS), and Next Generation networks.
3. To inculcate knowledge of Mobile Handsets with their design and Mobile Operating System with their features.
4. To enhance knowledge on Mobile Internet Applications with respect to Thin Client, Wireless Application Protocol (WAP) and various Markup Languages.

Pre-requisites :

- Computer Networks (18MCA31)

Unit – I 08 Hours

Introduction to Mobile Computing and its Architecture

Introduction to Mobile Computing: Mobile Computing Functions, Mobile Computing Devices, Dialogue Control. Networks: Wireline Networks, Wireless Networks, Ad hoc Networks, Bearers. Middleware and Gateways: Communication Middleware, Transaction Processing Middleware, Behavior Management Middleware, Communication Gateways. Players in the Wireless Space.

Mobile Computing Architecture

Type of Networks, Architecture for Mobile Computing, Three-Tier Architecture that includes Presentation (Tier-1), Application (Tier–2), and Data (Tier-3).

Design Considerations for Mobile Computing

Client Context Manager, Context Aware Systems.

Unit – II 08 Hours

Global System for Mobile Communication (GSM) and Short Message Service (SMS) Introduction to Global System for Mobile Communications, GSM Architecture, GSM Entities: Mobile Station, The Base Station Subsystem, The Network and Switching Subsystem, The Operation and Support Subsystem (OSS), Message Centre. Call Routing in GSM: An Example. Public Land Mobile Network (PLMN) Interfaces, GSM Address and Identifiers, Network Aspects in GSM, Mobility Management: Paging, Location Update, Handover, Roaming, Roaming Example. GSM Frequency Allocation.

Short Message Service (SMS)

Strengths of SMS, SMS Architecture, Short Message Mobile Terminated (SM MT), Short Message Mobile Originated (SM MO). SMS as an Information Bearer, Operator Centric Pull, Operator-independent Push, Challenge for SMS as a Mobile Computing Bearer, Operator-independent Pull.

Unit – III **10 Hours**

Wireless Networks – 2: GPRS

Introduction, GPRS and Packet Data Network: Capacity and Other End-User Aspects, Quality of Service (QoS). GPRS Network Architecture: GPRS Network Enhancements, Channel Coding, Transmission Plane Protocol Architecture. GPRS Network Operations: Attachment and Detachment Procedure, Routing.

Data Services in GPRS

GPRS Handsets, Device Types, Bearers in GPRS. Applications for GPRS: Generic Applications, GPRS-Specific Applications. Limitations of GPRS.

Unit – IV **08 Hours**

Next Generation Networks

All in One-The Converged Scenario; Narrowband to Broadband; All IP and B3G Network; OFDM (Orthogonal Frequency Division Multiplexing); FAMA/DAMA; Multi Protocol Label Switching (MPLS); Wireless Asynchronous Transfer Mode; Multimedia Broadcast Services; Multiple Play and Future Trends.

Unit – V **11 Hours**

Mobile Operating System, Mobile Computing Environment, and Mobile Internet Applications

Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: Windows CE (WinCE), Palm Operating System, Simian Operating System, Linux, and Proprietary Operating System Client Development: The Development Process, Need Analysis Phase, Design phase, Implementation/Testing Phase, Deployment Phase, Development Tools, and Device Emulators.

Thin client

Architecture, The client, Middleware, Messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, Handheld Device Markup Language (HDML), Wireless Markup Language (WML), Hypertext Markup Language (HTML), Compact Hypertext Markup Language (cHTML), Extensible Hypertext Markup Language (XHTML), and Voice Extensible Markup Language (VoiceXML).

Text Books	
1.	Dr. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal: Mobile Computing Technology, Applications and Service Creation, Second Edition, Tata McGraw Hill, 2010.
2.	Martyn Mallick: Mobile and Wireless Design Essentials, Wiley, 2003.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** Mobile computing Architecture, and describe design considerations for Mobile Computing.	L5
2.	**Explain** Mobile Phones, Mobile OS and their features.	L5
3.	**Interpret** Global Systems for Mobile Communications (GSM) and	L5

	Short Service Message (SMS), GPRS, Packet Data Network, and Next Generation Networks.	
4.	**Evaluate**the complete phase of software development life cycle of any mobile application.	L5
5.	**Propose**a Mobile Internet Application using the state of the art technologies and various Markup Languages.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**1**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.	**2**

Course delivery methods

1. **Lecture**
2. **Power-Point Presentation**
3. **Video**

Assessment methods

1. **Internal Assessment Test**
2. **Quiz**
3. **Assignment/Seminar/Project**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	**15 + 15 = 30**	**10**	**10**	**50**
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 20.**
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting at least one full question from each unit.

Mobile Application Laboratory

Course Code	**18MCA56**	**Credits**	1
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-2	**SEE Marks**	50 marks
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To provide basic knowledge on application development in android.
2. To emphasize on using views, view groups, layouts, menus and event handling mechanisms for basic UI designing.
3. To guide how to use the modern frameworks like IONIC and firebase for application development.
4. To give a brief idea on designing applications using database like SQLite.

Pre-requisites :

- Mobile Application Development (18MCA51)

Laboratory Exercises:

1. **Minimum 6 experiments can be framed by using a combination of these concepts:**
   a. GUI designing using different layouts, views and menus.
   b. Activities, intents and managing states
   c. Android SQLite Databases.

2. **Minimum 2 Open ended apps can be framed on:**
   a. Using IONIC and firebase framework
   b. Server based database application.

Text Books	
1.	Neil Smyth, Android Studio 3.0 Development Essentials Android 8 Edition, Payload Media, Inc. 2017
2.	Hoc Phan, Ionic Cookbook,Packt Publishing Ltd, 2015

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	**Choose** views, view group, layouts and menus as per the design requirements.	**L 3**
2.	**Develop** applications using activities and intents	**L 3**
3.	**Design** application with database SQLite	**L 3**
4.	**Build** android based applications usingIONIC framework and firebase.	**L 6**

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	4
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	5
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	6

Program Specific Outcomes (PSOs)

1.	PSO1: Professional Skills: The ability to understand, analyse and develop computer programs in the areas related to algorithms, system software simulation, software design, web design, big data analytics and networking.
2.	PSO2: Problem Solving Skills: The ability to apply standard practices and programming strategies in the software project development using open ended programming environments to deliver quality applications resulting in the success of business.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum	30	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 20 marks out of 50**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

C# Programming Laboratory

Course Code	**18MCA57**	**Credits**	01
Course type	CC	**CIE Marks**	50
Hours/week: L-T-P	0-0-2	**SEE Marks**	50
Total Hours:	28	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To impart knowledge of various programming constructs in C# along with object oriented techniques.
2. To introduce windows based application development with database connectivity.
3. To integrate ADO.NET services and build dynamic web applications.
4. To emphasize on professional web application development using master page and validation controls.
5. To introduce application development with non relational database.

Pre-requisites :

- .NET Programming using C# (18MCA52)

PART A
List of Experiments

Minimum 05 experiments can be framed on the following concepts:

1. Checked and unchecked exceptions
2. Indexers
3. Polymorphism using indexers
4. Encapsulation using properties
5. Partial Classes

PART B

Develop 2 windows applications using two different data providers and following GUI components

- MDI Forms, Menu Bar, Labels, TextBoxes, Buttons, Group Boxes, ListBox, RadioButtons, CheckedBox, ComboBox, Date Time Picker etc.

Develop 2 web applications using

- Relational database
- MongoDB

Text Books	
1.	NET 4.5 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiely-Dream Tech Press
2.	Anne Boehm, Joel Murach, Murach's ASP.NET 4 web programming with C# 2010, Mike Murach& Associates Inc.; 4th edition4th Edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Apply** Object oriented concepts using C# programming language.	L3
2.	**Make use of** checked unchecked exceptions and partial classes to develop console applications.	L3
3.	**Develop** windows form applications by selecting appropriate database providers with connectivity using ADO.NET services.	L6
5.	**Develop** web application withnon relational database as back end.	L6

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	**4**
2.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	**5**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**

Program Specific Outcomes (PSOs)

1.	**PSO1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
2.	**PSO2: Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality applications for business success.

Assessment methods

1. Internal Lab Test
2. Conduction of experiments in regular lab
3. Journal write-up

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab and Attendance	Journal submission	Lab test	Total Marks
Maximum	30	10	10	50
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 20 marks out of 50**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 3 hours duration.
2.	Two Experiments to be conducted one each from Part A and Part B.
3.	Minimum marks required in SEE to pass: 20 out of 50

4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Project Work-1

Course Code	**18MCA58**	**Credits**	01
Course type	CC	**CIE Marks**	50
Hours/week: L-T-P	0-0-2	**SEE Marks**	50
Total Hours:	--	**SEE Duration**	3 Hours for 50 Marks

Course learning objectives

1. To emphasize the importance of literature survey, identification of problem and framing the problem definition
2. To explore various modelsfor development of the software.
3. To utilize appropriate programming language and tools for implementation
4. To explore various testing methodologies forvalidation of the software.
5. To emphasize oral and written communication through presentations

Pre-requisites:Software Development tools and technologies, Programming languages.

Guidelines

- A team of maximum two students must develop the mini project. However during the examination, each student must demonstrate the project individually.
- The team may implement project of their choice by using knowledge of the subjects they have learnt from 1st to 4thSemesterand any current technology relevant to their project.
- The team must submit a brief project report (25-30 pages) which include the following:
    1. Introduction
    2. Literature Survey
    3. Hardware & Software Requirements
    4. Software Requirements Specification
    5. Detailed Design
    6. Implementation (Source code and screenshots to be included)
    7. Testing
    8. Conclusion
    9. Future Enhancements.
    10. Bibliography

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** and formulate the project and **analyze** existing system by carrying outliterature survey and relate it to current project.	L4
2.	**Make use of** intensiveliterature survey to prepare a detailed design of the system.	L3
3.	**Develop**the software by using modern tools and technologies.	L6
4.	**Construct** the test cases for the software using modern testing techniques and Present the outcome using good oral and writing skills.	L6

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications.	**4**
2.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**
3.	Postgraduates will be able to communicate effectively in both verbal and written form.	**8**

Program Specific Outcomes (PSOs)

1.	**PSO1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, simulation, software design, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
2.	**PSO2: Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality application for business success.
3	**PSO3: Successful Career and Entrepreneurship:** The ability to employ modern computer languages, technologies, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

Scheme of Continuous Internal Evaluation (CIE):

Components	Phase-1	Phase-2	Phase-3	Report	Total Marks
Maximum	10	15	15	10	50
	➢ Submission and certification of project report is compulsory to qualify for SEE.				
	➢ **Minimum marks required to qualify for SEE: 20**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Minimum marks required in SEE to pass: 20 out of 50**		
3.	Demonstration of the Project.	30 marks	50 marks
	Report	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

VI Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Contact Hours/Week	Credits	CIE Marks	SEE Marks		Total Marks
								Demonstration, Presentation and Viva	Dissertation	
1	18MCA61	Internship	CC	NA	Full Time	4	50	--	--	50
2	18MCA62	Project Work-2	CC	NA	Full Time	15	50	100	50	200
3	18MCA63	Seminar	SC	NA	2	2	50	-	-	50
3	18MCA64	Certification-1 (Cambridge Certification)	CC	NA	1	1	--	--	--	--
4	18MCA65	Certification-2 (Technical Certification)	CC	NA	1	1	--	--	--	--
			Total	NA	--	23	150	100	50	300

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination **L:** Lecture **T:** Tutorial **P:** Practical
CC: Compulsory Core **SC:** Seminar Component **NA:** Not Applicable

18MCA64 and 18MCA65: Certification Courses

Internship

Course Code	**18MCA61**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	NA	**SEE Marks**	--
Total Hours:	--	**SEE Duration**	--

Guidelines for Internship:

1. The student shall undergo Internship for 4-6 weeks during vacations and Internship should be presented along with the report by the end of 6 weeks.
2. Internship has to be carried out in an IT solution company only. **It should not be carried out in a learning institute.**
3. Internship has to be continuously monitored by the Internal guides and can be disapprove by them if not found suitable.
4. Internship should be preferably related to the project work even if the internship and projects are carried out in two separate organizations.
5. Internship may be carried on any technology/ tool and that may be used in project work OR it can be a feasibility study of the undertaken project work OR it can be existing system study.
6. Internship can also be viewed as training program.
7. Internship should comprise of the functionality part of the project, like specific packages, APIs, libraries or advanced frameworks. **It should not comprise of programming language or any course covered in regular curriculum.**
8. After completion of Internship students have to give presentation and submit report.
9. Report and presentation should consist of following information.

Sl No.	Content	Page Number
1.	Executive Summary	
2.	Company Profile	
3	Tools and Technologies Learnt	
4.	Skills Set Developed (outcome of Internship)	
5.	References	

10. **Evaluation Criteria** : Internship should be evaluated for 50 Marks as CIE. Out of which 15 marks is for the external guide (Industry person) evaluation, 15 marks evaluation by the internal guide and 20 marks for the presentation (Evaluated by External Examiner).

*****

Project Work-2

Course Code	**18MCA62**	**Credits**	15
Course type	CC	**CIE Marks**	50
Hours/week: L-T-P	NA	**SEE Marks**	150
Total Hours:	--	**SEE Duration**	3 Hours for 150 Marks

Course learning objectives

1. To explore the industry environment and get acquainted with the tools and technologies used
2. To emphasize the importance of literature survey, identification of problem and framing the problem definition
3. To incorporate variousdesign techniques
4. To utilize industry standard procedures and tools for implementation
5. To explore the validation of software/ application using various testing methodologies
6. To emphasize on oral and written communication through presentations

Pre-requisites:Software Development tools & technologies, Programming languages.

Guidelines

1. Students are required to take up individual project in companies/Respective Colleges other than the mini project standards already taken up during previous semesters.
2. Project should be real time work, for total of 4 months' duration
3. Project work may be application oriented or research oriented as per student and guide's interest. Therefore, the project reports will vary depending on whether it is application oriented project or research based project
4. Students should submit project offer letter their respective guides before starting of the project.
5. Seminars / presentation should be given on Synopsis, Software Requirement Specifications, Design and Project Completion levels.Advancement in project development must be presented in front of panel during phases.
6. If project report is not as per the format and not a real-time project, external examiners will have every right to reject the project.
7. Students are encouraged and appreciated to demonstrate the project / run time behaviour(video) along with power point slides during their viva-voce exams
8. The outcome of the project should be encouraged to present/publish in reviewed Conferences/Journals as papers.
9. Problem formulation, literature survey and submission of synopsis of the project to the project committee with approval of the internal guide within Three weeks from the commencement of 6^{th} semester.
10. Submission and certification of project report is compulsory to qualify for SEE.
11. Failing to meet the above process by candidate may lead to disqualification of the candidate's project work-2 (18MCA62) course and eventually award of the degree.

Guidelines for the Preparation of Project Reports

1. Printing Area: The margins should be: **Left:** 1.25", **Right**: 1.00", **Top and Bottom**-1.00". The text should be justified to occupy the full line width, so that the right margin is not ragged, with words hyphenated as appropriate. Please fill pages so that the length of the text runs to the right margin.

2. The report must be printed on one side only. Please use a high-resolution printer, preferably a laser printer with at least 300 dpi. Project reports must be printed neatly on one side of the paper on a A4 size bond paper. The reports submitted to the department/guide(s) must be hard bounded with dry tone Xerox.

3. Abstract: The abstract should summarize the contents of the report and should contain at least 150 and at most 350 words. It should be set in 12-point font size. There should be two blank (10-point) lines before and after the title **ABSTRACT**.

4. Layout, Typeface, Font Sizes, and Numbering: For the main text, please use 12-point type and 1.5-line spacing. We recommend using **Times New Roman** fonts. Italic type may be used to emphasize words in running text. Bold type and underlining should be avoided.

5. Headings.

The chapter headings should be in capitals and must be separated from the other text by 24point line space. Headings should be in the form where each word is capitalized (i.e., nouns, verbs, and all other words except articles, prepositions, and conjunctions should be set with an initial capital) and should, with the exception of the title, be aligned to the left. The font sizes are given in Table 1.

Here are some examples of headings: “Criteria to Disprove Context-Freeness of Collage Languages”, “On Correcting the Intrusion of Tracing Non-Deterministic Programs by Software”, “A User-Friendly and Extendable Data Distribution System”, “Multi-flip Networks: Parallelizing GenSAT”, “Self-determinations of Man”.

Table 1 Font sizes of headings. Table captions should always be positioned above the tables. The final sentence of a tablecaption should end without a period

Heading	Example	Font Size and Style
Title	Chapter 1Introduction	16 Point Bold
First Level Heading	1.1. Preamble	14 Point Bold
Second Level Heading	2.3.1. Mandatory or Regulatory Signs	12 Point Bold
Third Level Heading	Stop and Giveaway signs	12 Point Bold
Fourth Level	Heading *Creation of database*	*1*2 Point Bold Italicized

Figures and Photographs

Check that in line drawings, lines are not interrupted and have constant width. Grids and details within the figures must be clearly readable and may not be written one on top of the other. The lettering in figures should have a height of 2 mm (10-point type). Figures should be scaled up or down accordingly.

Figures should be numbered and should have a caption which should always be positioned under the figures, in contrast to the caption belonging to a table, which should always appear above the table. Please center the captions between the margins and set them in 9-point type (Fig. 1 shows an example). The distance between text and figure should be about 12 point spacing, the distance between figure and caption about 6 point spacing.

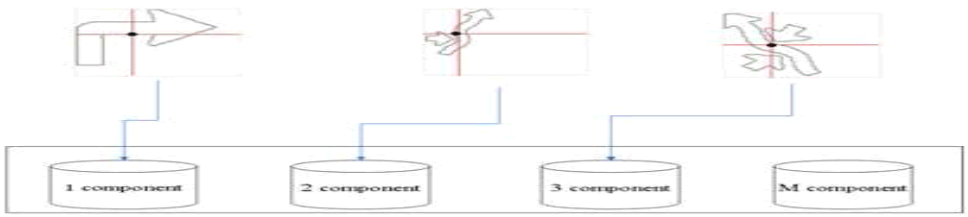

Fig 1.1. The last sentence of a figure caption should generally end without a period

6. Formulas

Displayed equations or formulas are centered and set on a separate line (with an extra line or half line space above and below). Displayed expressions should be numbered for reference. The numbers should be consecutive within each section or within the contribution, with numbers enclosed in parentheses and set on the right margin.

For example, A correlation matrix is computed using equation (5), Here, and are the feature vectors of query examples and and is the dimension of feature.

7. Program Code

Program listings or program commands or algorithms in the text are normally set in typewriter font, e.g., CMTT10 or Courier.

Example of an Algorithm is

Algorithm-1: Database Creation (Mean and Standard Deviation based approach)

Fig 1.1. The last sentence of a figure caption should generally end without a period.

Input: Static images of potential traffic sign
Output: Database created.
Methodology:
For each input image do
Step1: Preprocess the image as explained in section 4.3.1
Step2: Calculate the number of components in a sign as explained in section 4.3.1.
Step3: calculate a feature vector as mentioned in section 4.3.2.1.
Step4: Store the feature vector computed in step 3 in the corresponding database, based on number of components present in the sign. For End.
Algorithm End.

8. Footnotes/ Header

Footnotes/Header should appear at the bottom of the normal text area, with a line of about 5 cm in Word set immediately below/above the text.

Header sample: (Project title is left aligned and page number is right aligned)
<<Project Title>><<Page Number>>

Sample Footer:
<College Name> Department of MCA 2019-2020

9. The list of references is headed "References" and is assigned a number with square brackets in the decimal system of headings. The list should be set in small print and placed at the end of the dissertation, in front of the appendix, if any exists. Please do not insert a page break before the list of references if the page is not completely filled. An example is given at the end of this information sheet in the following format : <Name of Authors>,<Title of the paper>,<Conference name/Journal Name>,<Journal Series and volume (for journals)>,<page numbers>,<year of Publication>.An example for conference in journal are as follows:

- [1] J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320
- [2] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

10. Any references mentioned should be referred in the content of the report by using the

relevant reference number inside square bracket.

11. Page Numbering

Reports must be printed with page numbers on the top right corner.

12. The total number of reports to be prepared are three
· One copy to the concerned guide
· One copy for college
· One copy to candidate
· Two CD's having soft copy of Project report (for department purpose)

13. Before taking the **final printout**, the approval of the concerned guide is mandatory and suggested corrections, if any, must be incorporated.

14. Every copy of the report must contain (See formats towards the end of this document)

1. Outer title page (off white) with a plastic cover
2. Inner title page (White)
3. Certificate in the format enclosed, only certificate will be signed by following:
   - Principal
   - HOD
   - Internal guide and External guide (if project is carried out in company)
   - Guide and/or Co-guide (if project is carried out in college)

15. The **organization of the report** should be as follows

1. Inner title page
2. Certificate
3. Project Completion certificate from Company / College
4. Declaration (by student)
5. Acknowledgement
6. Abstract
7. Table of Contents
8. List of table and figures
9. Main body of project

Care should be taken to avoid spelling and typing errors. The student should note that report (write-up) should include the important component in the overall evaluation of the project. Sample content (more suitable for Application oriented projects) is attached and number of pages may be 40-70, which can be modified as per guide's instructions depending on the project under development. The respective guides can decide how the content of the project report must be organized if the project is research oriented, as a specific format cannot be defined for various domains of research problems.

Note 1 :
Proper attention has to given to the technical contents as well as to the organization of the report and clarity of the expression.

Note 2 :
All the students should submit the report for each phase to the internal guides one week before the scheduled phase dates.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify** the project and **summarize** literature survey related to the project	L3

2.	**Make use of** intensiveliterature survey to prepare a detailed design of the system.	L3
3.	**Develop** the software using modern tools/ technologies/ frameworks as per industry standards	L6
4.	**Construct** the test cases for the software using modern testing techniques and validate the software	L6
5.	**Defend** the project using good oral and written presentation skills	L5

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate the ability to design a system, component or process as per the needs and specifications.	**4**
2.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**
3.	Postgraduates will be able to communicate effectively in both verbal and written form.	**8**
4.	Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**12**

Program Specific Outcomes (PSOs)

1.	**PSO1:Professional Skills:**The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software simulation, software design, web design, big data analytics and networking.
2.	**PSO2:Problem Solving Skills:** The ability to apply standard practices and programming strategies in the software project development using open ended programming environments to deliver quality applications resulting in the success of business.
3.	**PSO3:Successful Career and Entrepreneurship:**Develop techniques to enhance ability for lifelong learning; as well as develop ability to setup a company that provides a platform for creating innovative projects by applying modern computer languages, tools, technologies, environments and platforms.

Scheme of Continuous Internal Evaluation (CIE):

Components	Phase-1	Phase-2	Phase-3	Report	Total Marks
Maximum	10	15	15	10	50
	➢ Submission and certification of project report is compulsory to qualify for SEE.				
	➢ **Minimum marks required to qualify for SEE: 20**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 150 marks of 3 hours duration**.**
2.	**Minimum marks required in SEE to pass: 60**
3.	**Internal Examiner and an expert from Industry/ Academia will jointly evaluate the project work-2.**

Seminar

Course Code	18MCA63	Credits	02
Course type	SC	CIE Marks	50 marks
Hours/week: L-T-P	NA	SEE Marks	--
Total Hours:	--	SEE Duration	--

Course learning objectives

1. To provide a systematic and independent study of a contemporary topic in a specialized area of research from any domain of computer science.
2. To develop technical paper writing skill.
3. To emphasize on communication capability of the student to present a technical topic.

Guidelines

1. This course is mandatory for all students pursuing MCA degree.
2. Seminar topics to be chosen from after studying papers published in reputed journals like IEEE/ Springer/Elsevier (Science Direct)/Scopus/DBLP indexed conference papers etc.
3. The CIE marks for Seminar is 50 (Distribution of this mark is given in a table with heading 'Scheme of Continuous Internal Evaluation (CIE)').
4. Total credits for seminar are 2 credits.
5. Student may select the topic for the seminar from the domain in which he/she is doing project work for the final semester.
6. The student has to contact his/ her guide and discuss the topic and the publication or presentation details.
7. Guide has the authority to disapprove the topic selected (if found incompetent).
8. The student shall prepare a research paper on selected topic and present / publish it in any national / International conference or journal or symposium.
9. At the time of evaluation, student should submit all the details viz. conference certificate or hard copy of the paper published.
10. Panel has the full authority to evaluate the seminar.
11. Student should submit the seminar report as per IEEE format and should consist of at least 8-10 pages (For IEEE format students are advised to visit https://www.coep.org.in/page_assets/491/IEEE_Template_4.pdf).

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Choose** a seminar topic from contemporary research area in the domain of computer science.	L5
2. **Make use of** intensive literature review to develop content.	L3
3. **Explain** the content using presentation tool	L5
4. **Interpret** the findings in IEEE format and communicate the same for publication in a reputed Journal/Conference.	L5

Program Outcome of this course (POs)	PO No.
1. Postgraduates will be able to communicate effectively in both verbal and written form.	8

2. Postgraduates will develop confidence for self-education and ability for life-long learning. **10**
3. Postgraduates will use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. **12**

Scheme of Continuous Internal Evaluation (CIE):

Topic relevance	**Content**	**Presentation**	**Adherence to IEEE format**	**Impact factor/significance of conference / journal(applicable only if the paper is published)**
5	20	10	5	10 (Distribution of this mark is given at the 'Note' below this table)
Note: Minimum duration for presentation is 12 minutes + 3 minutes QA				

NOTE: For CIE (publication) component, the marks distribution is as follows:
(Internal guides have to maintain record for the same for the students under them)

- For publication in reputed journal (like IEEE/Scopus/SCI indexed journals etc.) – **10 marks.**
- If presented/communicated in reputed conferences (like IEEE/Springer/ACM etc.)- **08 marks**
- If communicated to any other journal/conference – **05 marks.**
- If not published or presented in any conferences – **Zero marks.**