KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Department of Master of Computer Applications

Scheme and Syllabus (2015 Scheme)

1st Semester Master of Computer Applications (M.C.A.)

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.

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 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 SPECIFIC OUTCOMES (PSOs):

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.

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.

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.

Scheme of Teaching

I Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours	CIE Marks	SEE Marks	Total Marks
1	15MCA11	UNIX and Shell Programming	CF	4-0-0	4	4	50	50	100
2	15MCA12	Web Programming	CF	4-0-0	4	4	50	50	100
3	15MCA13	Digital Systems and Computer Organization	CC	4-0-0	4	4	50	50	100
4	15MCA14	Computer Programming Language (C)	CC	3-1-0	4	5	50	50	100
5	15MCA15	Discrete Mathematics	CC	4-0-0	4	4	50	50	100
6	15MCA16	UNIX & Shell Programming Laboratory	CC	0-0-1	2	3	50	50	100
7	15MCA17	Web Programming Laboratory	CC	0-0-1	2	3	50	50	100
8	15MCA18	Computer Programming Laboratory (C)	CC	0-0-1	2	3	50	50	100
			Total	**19-1-3**	**26**	**30**	**400**	**400**	**800**

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

UNIX and Shell Programming (Theory)

Course Code	15MCA11	Credits	4
Course type	CC	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Focusing on its history, architecture, the file system, process, 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 :

1. A basic understanding on various computer concepts and working knowledge in any programming language.
2. Knowledge about Operating System and its functionalities.

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

Self learning topics:

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.

Self learning topics:

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.

Self learning topics: Debugging Scripts

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

Self learning topics: Interval Regular Expressions and Tagged Regular Expressions.

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.

Self learning topics: Practicing the commands learnt in process topic.

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. Forouzan Gilberg, "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. **Explain** the fundamental UNIX concepts, architecture and features of UNIX operating system and demonstrate the flexibility of command usage.	L 2
2. **Classify** the file types with different file attributes and **demonstrate** file-handling techniques.	L 2, L 4
3. **Demonstrate** the use of pipes and filters like grep, sed using basic and extended regular expressions.	L 2
4. **Design** Shell programs for solving various problems using essential and advanced features of shell programming.	L 6
5. **Explain** process creation mechanism and identify kernel's role in Process Management & job scheduling.	L 2

Program Outcome of this course (POs)	PO No.
3. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
5. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6. 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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Web Programming (Theory)

Course Code	15MCA12	Credits	4
Course type	CF	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of Web Technologies.
2. Delivering the importance of HTML, JavaScript and XML.
3. Making use of different tools to develop Web Applications.
4. Imparting the knowledge of programming using XHTML, JavaScript and XML.
5. Guiding the students to construct simple JavaScript user interfaces and an ability to build 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
Self-Learning Topics:
Pattern Matching using regular expressions, Errors in scripts, Examples.

Unit – IV **10 Hours**

Dynamic Documents with JavaScript, Introduction to XML:
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.
Introduction, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets.
Self-Learning Topics:
XML processors, Web services

Unit – V **10 Hours**

Perl and CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.
Using Perl for CGI Programming: : The Common Gateway Interface; CGI linkage;
Query string format; CGI.pm module

Self learning topics: Cookies

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, WileyIndia, 2009.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** basic web concepts to build applications that are Object Based and Platform Independent.	L 2
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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units

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Digital Systems and Computer Organization (Theory)

Course Code	**15MCA13**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

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

Pre-requisites :
Idea of Basic Computer and its Operations

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

Self-Learning Topics: 8086 addressing modes and instruction sets, Examples

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,

Self-Learning Topics: Processor Examples,

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.

Books

1. M. Morris Mano , Michael D. Ciletti, Digital Design :With an Introduction to the Verilog HDL , 5th edition , Pearson
2. Carl Hamacher, Zvonko Vranesic Safwat Zaky, 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.	**Explain the** basic structure and operation of a digital computer.	L 2
2.	**Explain** logical gates and **design** different circuits using logic gates.	L 2, L 6
3.	**Demonstrate** the working of adders, subtractors in a computer system. [	L 4
4.	**Apply** the theorems and properties of Boolean algebra to simplify Boolean expression and **design** logical circuits.	L 3, L 6
5.	**Explain** different ways of communication with I/O devices and standard I/O interfaces.	L 2
6.	**Apply** arithmetic operations on binary number system.	L 3
7.	**Analyze** the performance of different computer systems by considering memory size, speed, architecture, and instruction set.	L 4
8.	**Explain** how programs and data are stored and represented in a computer system.	L 2

	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 a system, component or process as per needs and specifications.	**4**
4.	Postgraduates will develop confidence for self education and ability for life-long learning.	**10**
5.	Post graduates can participate and succeed in competitive examinations.	**11**

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Computer Programming Language (C) (Theory)

Course Code	**15MCA14**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-1-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of problem domain, Analyze and design the solution for a given problem with Representation of the solution in the form of flowchart/algorithm.
2. Computer programming languages share common fundamental concepts, and this course will introduce you to those concepts using the C programming language.
3. Write modular and professional with resourceful C programs for various scientific engineering and business domains.
4. Exhibit verification and validation of the program correctness. Use of good programming practices required in the industry.

Pre-requisites :

Knowledge of mathematics including operator precedence.

Unit – I **11 Hours**

Algorithms and Flowcharts, Constants, Variables and Data Types, Operators and Expressions, Managing Input and Output Operations: The meaning of algorithms, Flowcharts and their need, Writing algorithms and drawing flowcharts for simple exercises like finding biggest of three numbers, to find roots of given quadratic equation, to find the biggest and smallest of given set of numbers and such other simple examples**.**

Character set, C tokens, keywords & identifiers, structure of C program, executing a C program. Constants, variables, data types, declaration of variables, declaration of storage classes, assigning values to variables defining symbolic constants, declaring a variable as constant, declaring a variable as volatile, overflow and underflow of data.

Arithmetic operators, relational operators, logical operators, assignment operator, increment and decrement operator, conditional operator, bitwise operators, comma operator, special operators, arithmetic expressions, evaluation of expressions, precedence of arithmetic operators, type conversions in expressions, operator precedence and associativity, mathematical functions.

The scanf() & printf() functions for input and output operations, reading a character, writing a character, (the getchar() & putchar() functions) , the address operator(&), formatted input and output using format specifiers, Writing simple complete C programs.

Self learning topics: gets(), puts(), Advance format specifiers.

Unit – II **10 Hours**

Control Statements, Loop Control Structures: Decision making with if statement, simple if statement nt, the if..else statement, nesting of if..else statements, the else..if ladder, the switch statement, the ? : operator, the goto statement, the break statement, programming examples.

The while statement, the do..while statement, the for statement, nested loops, jumps in loops, the continue statement, programming examples**.**

Unit – III **10 Hours**

Arrays, Character Arrays and Strings: The meaning of an array, one dimensional and two dimensional arrays, declaration and initialization of arrays, reading, writing and manipulation of above types of arrays, multidimensional arrays, dynamic arrays, programming examples.

Declaring and initialing string variables, reading string from terminal, writing string to screen, arithmetic operations on characters, putting strings together, comparison of two strings, string handling functions, table of strings, other features of strings, programming examples.

Self learning topics: Dynamic array

Unit – IV **11 Hours**

User Defined Functions, Structures and Unions: Need for user defined functions, a multi function program, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, category of 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, nesting of functions, recursion, passing arrays to functions, passing string to functions, programming examples.

Defining a structure, declaring structure variables, accessing structure members, structure nitialization, copying and comparing structure variables, operations on individual members, array of structures, structures within structures, structures and functions, Unions, size of structures, bit fields, programming examples.

Self learning topics: Passing structures using pointers.

Unit – V **10 Hours**

Pointers, File Management in C, Dynamic Memory Allocation, The Preprocessor: Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, chain of pointers, 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**.**

Defining and opening a file, closing a file, input/output operations on files, error handling During I/O operations, random access files, command line arguments, programming examples. Dynamic memory allocation, allocating a block of memory: malloc, allocating multiple blocks of memory: calloc, releasing the used space: Free, altering the size of a block: realloc, programming examples. Introduction, macro substitution, files inclusion, compiler control directives, ANSI additions, programming exercises .

Books

1. Balagurusamy, Programming in ANSI C, 3rd edition., Tata McGraw Hill, 2003.
2. Rajaraman, V. Computer Programming in C, Prentice Hall India, 2000.
3. Reema Thareja Programming in C, Oxford Higher Education

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Discuss** basics of computers hardware and number systems and to understand the basic terminology used in computer programming.	L 6
2.	**Adapt** the common data structures typically found in C programs namely arrays, strings, structures, unions and files.	L 6
3.	**Select** Unix commands to manage files and develop programs, including multi-module programs and make files.	L 5
4.	**Design** a computer program to solve simple and complex problems of different	L 6

domains.

5.	**Assess** industry standard programming styles and practices.	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 identify, formulate and solve engineering problems.	**2**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5.	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**
4.		4.	

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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Discrete Mathematical Structures (Theory)

Course Code	**15MCA15**	**Credits**	04
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**4-0-0**	**SEE Marks**	50 marks
Total Hours:	**52**	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of Set and is fundamental requirement to study DMS
2. The art of applying language of logic
3. To Explain them concepts of Relations, Functions.
4. Identify the problems involving number theory, permutations and combinations.
5. To Reproduce techniques of Mathematical Induction and Recurrence relations.
6. To Criticize that Graph theory is one of the important, essential, useful and Matrix oriented wonderful topic.

Pre-requisites : Set Theory

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.

Self learning topics: Basic connectives and truth tables

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.

Self learning topics: Directed graphs and zero one matrices.

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

Self learning topics: Directed graphs weighted graphs weighted trees trees and sorting.

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. **Discuss** the mathematical logic and construct logical arguments**. [L2]**	L 2
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]**	L 3
6. **Compare and Contrast** that Graph theory as one of the important, essential, useful and Matrix oriented wonderful topic. [L2]	L 2

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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UNIX and Shell Programming Laboratory (Lab)

Course Code	**15MCA16**	**Credits**	02
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. **Providing a clear understanding** of 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 :

1. Knowledge about Operating System and its functionalities.
2. A basic understanding on various computer concepts and working knowledge in any programming language

Laboratory Exercises:

Maximum 10 experiments can be framed on the following concepts:

General purpose utilities, File handling commands, Basic file attribute commands, Simple filters and Regular expressions, grep command, sed command, awk command

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. Forouzan Gilberg, "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. **Demonstrate** the flexibility of command usage.	L 2
2. **Classify** the file types with different file attributes.	L 4
3. **Demonstrate** file handling techniques.	L 2
4. **Appraise** vi editor and **demonstrate** different modes and features.	L 2, L 5
5. **Demonstrate** the use of pipes and filters like grep, sed.	L 2
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**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):

1. It will be conducted for 50 marks of 3 hours duration**.**
2. **Viva-voce shall be conducted for individual student and not in a group.**
3. **Minimum marks required in SEE to pass: 20**
4. Initial write up 20 marks
   Conduct of experiments 20 marks
   Viva- voce 10 marks
   50 marks
5. **NOTE: Change of program during lab examinations is not permitted**

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Web Programming Laboratory (Lab)

Course Code	15MCA17	Credits	02
Course type	CC	CIE Marks	50 marks
Hours/week: L-T-P	0-0-1	SEE Marks	50 marks
Total Hours:	42	SEE Duration	3 Hours for 50 marks

Course learning objectives

1. Providing knowledge of Web Technologies to build a Web Application.
2. Designing and developing front-end and back-end of a Web Application
3. Exploring the advantages of emerging Web Technologies and the environment in which they are used.

Prerequisites:

Knowledge of editors, explorers used in different Operating Systems

Laboratory Exercises:

Maximum 10 experiments can be framed on the following Concepts:

Basic text formatting tags, fonts, tables, external hyperlinks and Internal hyperlinks, on image insertion, Cascading Style Sheets(CSS), forms, JavaScript Arrays, JavaScript strings, string Manipulations, JavaScript operators, event handling, Extensible Markup Language(XML), XML Schemas, Document Type Definitions (DTD's) and XSLT style sheet, CGI and Perl programming.

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.	L 3, 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	**5**

3.	for multiple domains Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Computer Programming Laboratory (C) (Lab)

Course Code	**15MCA18**	**Credits**	2
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	50 marks
Total Hours:	**42**	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Providing a clear understanding of computer programming and emphasis problem solving on the fundamentals of structured design using the principles of Top Down problem solving strategy (divide and conquer).). This includes development, testing, implementation, and documentation.
2. The course also aims to explore the logic of programming via the algorithm concepts and implement them in programming structures including functions, arrays, strings, and pointers. This course of laboratory student should demonstrate: Problem solving ability, Code reviewing Skills, Code debugging Skills.

Pre-requisites :

1. Knowledge of programming language
2. Knowledge of editors used in different Operating systems
3. Knowledge of basic mathematics

Laboratory Exercises:

Maximum 10 experiments can be framed on the following topics:

Usage of variables and operations, control statements, loop control structures, static memory structures viz. arrays, Different operations on strings, User defined data types and functions, file structures and pointers.

Books

1. Balagurusamy, Programming in ANSI C, 3rd edition., Tata McGraw Hill, 2003.
2. Rajaraman, V. Computer Programming in C, Prentice Hall India, 2000.
3. Reema Thareja Programming in C, Oxford Higher Education

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Interpret** the fundamental programming constructs, searching and sorting techniques.	L 2
2.	**Identify** typical C-like program environment. **Analyze** Cognitive skills to find solution for any problem.	L 3, L 4
3.	**Develop** algorithms and Communication skills.	L 6
4.	**Develop** Transferable Skills to write C-like programs including all the concepts mentioned in the laboratory concepts using proper 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	**2**

	engineering problems.	
1.	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**
4.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
5.	Postgraduates will be able to communicate effectively in both verbal and written form..	**8**
6.	Post graduates can participate and succeed in competitive examinations.	**11**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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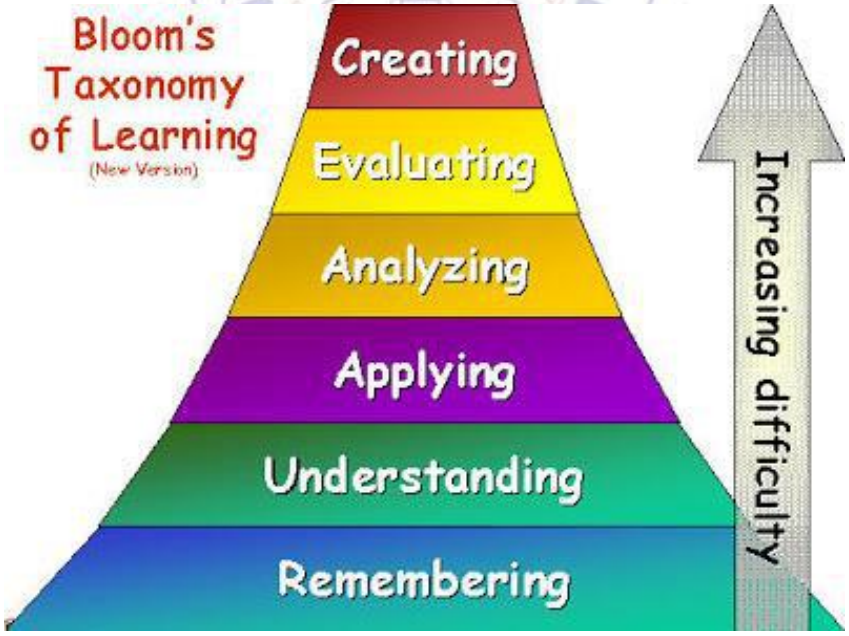
Bloom's Taxonomy of Learning Objectives

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
Semester

II Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours	CIE Marks	SEE Marks	Total Marks
1	15MCA21	Data Structures	CC	3-1-0	4	5	50	50	100
2	15MCA22	Database Management Systems	CF	4-0-0	4	4	50	50	100
3	15MCA23	Operating Systems	CC	4-0-0	4	4	50	50	100
4	15MCA24	Object Oriented Programming-1 (C++)	CC	4-0-0	4	4	50	50	100
5	15MCA25	System Software	CC	3-1-0	4	5	50	50	100
6	15MCA26	Data Structures Laboratory	CC	0-0-1	2	3	50	50	100
7	15MCA27	Database Management Systems Laboratory	CC	0-0-1	2	3	50	50	100
8	15MCA28	Object Oriented Programming-1 Laboratory (C++)	CC	0-0-1	2	3	50	50	100
			Total	**18-2-3**	**26**	**31**	**400**	**400**	**800**

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

Data Structures(Theory)

Course Code	**15MCA21**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-1-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing knowledge of fundamental data structures like stacks, queues, linked lists, and trees
2. Comparing and contrasting the costs and benefits of dynamic and static data structure implementations
3. Providing guidelines on selection of the appropriate data structure for modeling a given problem

Pre-requisites :
Computer Programming Language (C) (16MCA14)

Unit – I **10 Hours**

INTRODUCTION, RECURSION AND ADVANCED CONCEPTS IN C: Structure, unions and Pointer Revisit: Motivation for using structures. Pointer, Access data from memory through pointer, pointer to structures. Motivation for dynamic memory requirement. Realizing arrays using pointer and dynamic memory allocation. Importance of memory management during allocation and deallocation of memory. Recursion concepts and problem solving using recursion.
Self learning topics: Dynamic memory allocation for Arrays. Advantages of using dynamic memory allocations

Unit – II **11 Hours**

THE STACKS 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
Self learning topics: Program to convert an expression from infix to prefix, from prefix to postfix, postfix to infix. Implement stack and queue using dynamic memory allocations

Unit – III **11 Hours**

THE 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
Self learning topics: Compare arrays and lists. Lists using header node

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.
Self learning topics:AVL tree, Read and black tree, forests

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

Self learning topics: Compare time complexity for prescribed sorting techniques.

Books

1. YedidyahLangsam and Moshe J.Augenstein and Aaron M. Tenanbaum, Data structures using C , PHI. Reference books
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education Asia
3. AnanyLevitin, 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.	**Define** ADT (Abstract Data Types) and **classify** the basic techniques of algorithm analysis and implementation	L 1, L 2
2.	**Analyze** recursive methods	L 4
3.	**Access**, **analyze** and **construct** various operations on stacks and queues.	L 4, L 5, L6
4.	**Evaluate** and **translate** asymptotic notations	L 2, L 5
5.	**Create** linked data structures such as linked lists and binary trees	L 6
6.	**Appraise**, **analyze,** and **design** advanced data structures such as balanced search trees, hash tables	L 4, L 5, 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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6.	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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Database Management Systems (Theory)

Course Code	**15MCA22**	**Credits**	4
Course type	CF	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear knowledge of the nature of Database Management System including their structure, design, and evaluation
2. Correlating the relationship between DBMS and information systems used in libraries and business
3. Imparting knowledge on designing Entity-Relationship (ER) diagram
4. Analyzing the process of normalization in relational databases
5. Providing knowledge on writing Structured Query Language (SQL) and its standards in the current and future development of DBMS
6. Developing introductory level of skill set required in the use of selected microcomputer Database Management Systems

Pre-requisites : NA

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, 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

Relational Algebra: Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping

Unit – IV 12 Hours

SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

Unit – V 10 Hours

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, procedures. Creating and planningPL/SQL

Self learning topics: Indexes

Books

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

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain**the characteristics and functions of Database Management System	L 2
2.	**Explain** types of Database Users	L 2
3.	**Contrast** Data Models, Schemas, Instances, Three Schema Architecture and DBMS Component Modules	L 4
4.	**Design** Entity-Relationship (ER) modeling	L 6
5.	**Define** the concept of Relational Algebra and contrast the Relational Operations from Set Theory	L 1, L 4
6.	**Design** queries in SQL	L 6
7.	I**llustrate** the definition of Functional Dependencies, Inference Rules, and Equivalence of Sets of Functional Dependencies FDs, Minimal Sets of FDs	L 2
8.	**Plan** the three Normal Forms based on Partial and Transitive Dependencies	L 3
9.	**Apply** normalization techniques to normalize a database	L 3
10.	**Demonstrate** the use of PL/SQL for database	L 2

	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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
7.	Postgraduates can participate and succeed in competitive examinations	**11**
8.	Postgraduates will demonstrate research-based knowledge and research methods for addressing current issues in research trends	**12**

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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
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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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units

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Operating Systems (Theory)

Course Code	**15MCA23**	**Credits**	04
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the functions of operating system with respect to convenience, efficiency and its ability to evolve
2. Highlighting the different process states and data structures needed to support the management of many tasks
3. Summarizing the various approaches to solving the problem of mutual exclusion in an operating system
4. Providing an insight on memory hierarchy and cost-performance trade-offs and virtual memory
5. Discussing the concept of thrashing, both in terms of reasons it occurs and the techniques used to recognize and manage the problem

Pre-requisites :

A course on Digital Systems and Computer Organization (16MCA13)

Unit – I — 10 Hours

Introduction to Operating Systems, System structures : Introduction to operating systems; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process concept; Process scheduling; Operations on processes; Inter-process communication

Self learning topics: Comparative study of different operating system and Architectures.

Unit – II — 11 Hours

Multi-Threaded Programming, Process Synchronization: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors

Self learning topics: Exploring the essential aspects of sharing the resources among the users

Unit – III — 11 Hours

Deadlocks, Memory Management: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Memory Management Strategies: Background; Swapping; Contiguous memory allocation; aging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand aging; Copy-on-write; Page replacement; Allocation of frames; Thrashing

Self learning topics: Analyze theory and implementation of physical and virtual memory

Unit – IV — 10 Hours

File System, Implementation of File System, Secondary Storage Structures:

File System: File concept; Access methods; Directory structure; File system mounting; Protection.

Implementing File System: File system structure; Directory implementation ;Free space management
Mass storage structures; Disk structure; Disk attachment; Disk management; Swap space management

Unit – V **10 Hours**

Protection, Case Study: The Linux Operating System:

Goals of protection, Principles of protection, Domain of protection, Access control, Revocation of access rights, Capability-Based systems.

Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication

Self learning topics:

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. **Identify** systems calls and interrupts of any operating system	L 3
2. **Explain** Input/output, disk access, and file system facilities	L 2
3. **List** the features and limitations of an operating system used to provide protection	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**

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Object Oriented Programming – 1 (C++) (Theory)

Course Code	**15MCA24**	**Credits**	4
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing knowledge of basic Object Oriented Programming concepts
2. Comparing Modular programming with Object Oriented Programming and analyze the strengths and weaknesses of Object Oriented Programming
3. Inculcating the concepts of Operator Overloading, Function Overloading, Friend Functions, Friend Classes, Function Templates, and Class templates
4. Developing skills to write program in C++ using Classes and Objects and implement Encapsulation, Polymorphism and Inheritance
5. Handling run-time errors in a program and deal with files and input/output streams in C++.

Pre-requisites :
A course on C Programming (15MCA14)

Unit – I **10 Hours**

Introduction: Introduction to object oriented programming, Structured vs Object Oriented Paradigm, Characteristics of object-oriented programming, Elements of Object Oriented Programming: Object, Classes, Encapsulation & data abstraction, Inheritance, Polymorphism etc., C++ Overview, different data types, operators, expressions, const& volatile qualifiers, arrays and strings, reference variables, scope resolution operator

Unit – II **10Hours**

Classes & Objects: Introduction to Class specification, Class Objects, access members, defining member functions, data hiding, constructors, destructors, parameterized constructors, static data members, functions, passing objects as arguments, returning objects, friend functions & classes, arrays of objects, Dynamic objects – Pointers to objects

Unit – III **10 Hours**

Modular Programming with Functions: Function Components, argument passing, inline functions, function overloading, recursive functions, function templates and Class templates, Operator overloading using friend functions such as ++, --, [] etc
Self learning topics:STL: An overview, containers, vectors, lists maps

Unit – IV **11 Hours**

Inheritance, Virtual functions & Polymorphism: Base Class, Types of Inheritance, Inheritance & protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors & Inheritance. Passing parameters to base Class Constructors, granting access, Virtual base classes, Virtual function -Calling a Virtual function through a base class reference, Virtual attribute is inherited; Virtual functions are hierarchical, pure virtual functions, abstract classes, using Virtual functions, Early & late binding.

Unit – V **11 Hours**

I/O Streams & Exception Handling:IO Stream basics, output operator <<, input >>, additional I/O operators, overloading the output operator <<, overloading the input operator >>, file input & output, manipulators, Exception handling fundamentals, Exception handling options
Self learning topics: Data File handling

Books

1. Herbert Schildt, C++ The Complete Reference, 4th Edition, Tata McGraw Hill, 2007
2. K R Venugopal, Rajkumar,T., Ravi Shankar: Mastering C++, Tata McGraw Hill, 1997
3. E. Balaguruswamy: Object oriented programming with C++, TMH
4. M.T. Soamashekara: Object Oriented Programming with C++, PHI Learning, New Delhi

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** Object Oriented Programming Concepts	L 2
2.	**Distinguish** between procedure oriented programming and object oriented programming	L 4
3.	**Illustrate** concepts such as classes, objects, constructors, destructors, function overloading, operator overloading, generic functions and generic classes	L 2
4.	**Explain** the use of Friend Functions and Friend Classes	L 2
5.	**Develop** Programs using Encapsulation, Inheritance, and Polymorphism	L 6
6.	**Explain** the use of dynamic memory allocation, virtual functions, pure virtual functions, and abstract classes in C++.	L 2
7.	**Design** a mechanism to handle run-time errors in C++.	L 6
8.	**Illustrate** the use input/output streams and file handling mechanisms in C++.	L 2

	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**
4.	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**
4.		4.	

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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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System Software (Theory)

Course Code	**15MCA25**	**Credits**	04
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**3-1-0**	**SEE Marks**	50 marks
Total Hours:	**52**	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of design and implementation of various types of system software
2. Understanding the relationship between Machine architecture and System software
3. Identifying and Comparing Machine-independent aspects of software design and machine-specific details
4. Giving an insight into the programs for the machine being studied. The student should be exposed to the use of hypothetical computer (SIC) for instructional purposes. Firstly, because it avoids the problem of dealing with the irrelevant complexities and "quirks" found on most real computers. Secondly all students begin on equal footing. No student is at an unfair disadvantage because he or she happens to be unfamiliar with hardware and software system on which the text is based
5. Exploring the need of Lex and Yacc to create compilers and interpreters

Pre-requisites :

1. A course on Digital systems and computer organization (16MCA13)
2. Data structures. (16MCA21)

Unit – I — 11 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

Self learning topics: Program Relocation.

Unit – II — 11 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. Implementation Examples - MASM 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 — 10 Hours

Linkers, Editors and Debugging Systems

Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker. Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities.

Self learning topics: Relationship with Other Parts of the System, User-Interface Criteria

Unit – IV

Macro Processors **10 Hours**

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, Macro Processor Design Options - Recursive Macro Expansion, General- Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

Unit – V **10 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.

Self learning topics: Implementation and execution of simple lex/yacc programs.

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 (1991), Systems Programming, Tata McGraw –Hill Publishing company Ltd, New Delhi
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 2, L 3
2.	**Analyze** and d**esign** working of assemblers in terms of their machine dependency	L 4, L 6
3.	**Compare** between machine independent and machine specific details of Assemblers, Loaders, and Macroprocessors	L 4
4.	**Design** Loaders, Linkers and Macro processor	L 6
5.	**Explain** the working of Text editors, Macro processor and their design options	L 2
6.	**Identify** and **explain** the phases of compilers	L 2, L 3
7.	**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 will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**

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

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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Data Structures Laboratory (Lab)

Course Code	**15MCA26**	**Credits**	02
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Inculcating programming strategy using Top-Down approach to solve complicated problems.
2. Delivering knowledge on Principles of Programming Languages, Programming Methodologies, Design and Analysis of Algorithms using Data Structures
3. Developing skills to write algorithms implementing stacks, queues, linked lists, trees, and graphs
4. Imparting knowledge on Hashing Techniques, Searching Techniques and Sorting Techniques
5. Using the recursive algorithms in implementing trees and graphs
6. Familiarizing the issues of Time complexity and examine various algorithms from time complexity perspective

Pre-requisites :

1. Knowledge of structured programming language.
2. Problem solving and analytical understanding using programming language
3. Exposure to Unix and related Editor

Laboratory Exercises:

Maximum 10 experiments can be framed on the following concepts:

Recursion, stack, queues, linked lists, trees, Searching and Sorting techniques

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. **Design** well-structured complex programs using the concepts of data structures	L 6
2. **Construc**t and **analyze** different sorting algorithms like Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Shell sort and Heap sort	L 4, L 6
3. **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 5, L 6

4.	**Appraise** and **Design** the Stack ADT using both array based and linked-list based data structures and also implement Stack applications	L 5, L 6
5.	**Appraise** and **Design** the Queue ADT and Circular Queue ADT using both array based and linked-list based Data structures	L 5, L 6
6.	**Appraise** and **Design** binary tree ADT using linked list based data structures	L 5, L 6
7.	**Appraise** and **Design** AVL tree operations and implement graph traversal techniques	L 5, 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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6.	Postgraduates will develop confidence for self education and ability for life-long learning	**10**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Database Management System Laboratory (Lab)

Course Code	**15MCA27**	**Credits**	02
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	50 marks
Total Hours:	**42**	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Providing a clear understanding of Database Management System as a subject in its own right, rather than as a compendium of techniques and product-specific tools
2. Familiarizing the participant with the nuances of database environments towards an information-oriented data processing oriented framework
3. Giving a good formal foundation on the relational model of data and also to present SQL and procedural interfaces to SQL comprehensively
4. Introducing systematic database design approaches covering conceptual design

Laboratory Exercises:

Maximum 8 experiments can be framed on the following concepts:

Integrity rules and simple queries, nested queries, type of joins, views, aggregate functions, PL/SQL using triggers and procedures.

Books

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

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 2, L 6
2. **Contrast** Data Models, Schemas, Instances, Three Schema Architecture and DBMS Component Modules	L 4
3. **Design** Entity-Relationship (ER) modeling	L 6
4. **Define** the concept of Relational Algebra and **contrast** the Relational Operations from Set Theory	L 1, L 4
5. **Design** queries in SQL	L 6
6. **Illustrate** the Definition of Functional Dependencies, Inference Rules, Equivalence of Sets of Functional Dependencies FDs, Minimal Sets of FDs	L 2
7. **Apply** normalization techniques to normalize a database	L 3

8.	**Demonstrate** the use of PL/SQL for database	L 2

	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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
7.	Post graduates can participate and succeed in competitive examinations	**11**
8.	Postgraduates will demonstrate research-based knowledge and research methods for addressing current issues in research trends	**12**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Object Oriented Programming –1 Laboratory (C++)(Lab)

Course Code	**15MCA28**	**Credits**	2
Course type	**CC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	50 marks
Total Hours:	**42**	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Providing knowledge of C++ Editors and writing programs using Classes and Objects
2. Introducing concepts like operator overloading, function overloading, function templates and class templates and implement them using C++.
3. Implementing the three traits of Object Oriented Programming, namely, Encapsulation, Inheritance and Polymorphism using C++
4. Inculcating the knowledge of handling Input/output Streams, Exceptions and Files in C++

Pre-requisites :
Knowledge of C language

Laboratory Exercises:
Maximum 10 experiments can be framed on the following Concepts:
Classes and objects, Overloading functions, Template function, Class template, Operator overloading, Copy constructor, Virtual base class and inheritance, Pure virtual function and polymorphism, Exception handling.

Books

1. Herbert Schildt: C++ The Complete Reference, 4th Edition, Tata McGraw Hill, 2007
2. K R Venugopal, Rajkumar,T., Ravi Shankar: Mastering C++, Tata McGraw Hill, 1997
3. E. Balaguruswamy: Object oriented programming with C++, TMH
4. M.T. Soamashekara: Object Oriented Programming with C++, PHI Learning,New Delhi
5. Stanley B.Lippmann, JoseeLajore: C++Primer, 4th Edition, Addison Wesley, 2005
6. Stephen Prata : C++ Primer Plus, 6th Edition, Person Education.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** the concept of Classes and Objects	L 2
2. **Demonstrate** function overloading, operator overloading, function templates and class templates	L 2
3. **Develop** programs to implement Encapsulation, Inheritance and Polymorphism	L 6
4. **Develop** programs that can handle exceptions, files and input/output streams	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**
4. 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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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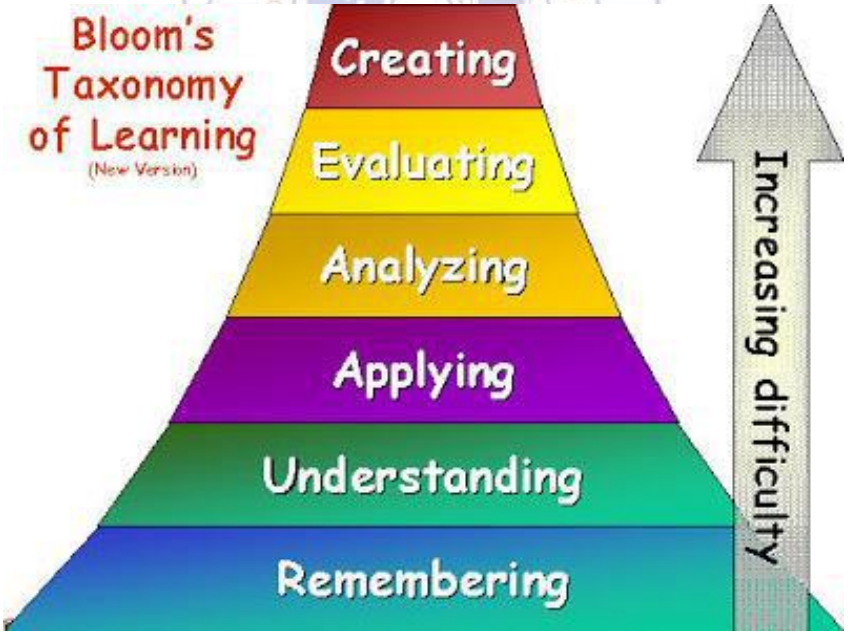
Bloom's Taxonomy of Learning Objectives

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.



KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Department of Master of Computer Applications

Scheme and Syllabus (2015 Scheme)

3rd Semester Master of Computer Applications (M.C.A.)

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.

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 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 SPECIFIC OUTCOMES (PSOs):

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.

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.

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.

Scheme of Teaching

III Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours	CIE Marks	SEE Marks	Total Marks
1	15MCA31	Computer Networks	CF	4-0-0	4	4	50	50	100
2	15MCA32	Object Oriented Programming-2 (Java)	CC	3-1-0	4	5	50	50	100
3	15MCA33	Software Engineering	CC	4-0-0	4	4	50	50	100
4	15MCA34	Internet Web Programming	FE	4-0-0	4	4	50	50	100
5	15MCA35	MIS & E-Commerce	FE	4-0-0	4	4	50	50	100
6	15MCA36	Computer Networks Laboratory	CC	0-0-1	2	3	50	50	100
7	15MCA37	Object Oriented Programming-2 Laboratory (Java)	CC	0-0-1	2	3	50	50	100
8	15MCA38	Internet Web Programming Laboratory	CC	0-0-1	2	3	50	50	100
			Total	**19-1-3**	**26**	**30**	**400**	**400**	**800**
9	15MCA39	**Bridge course (Lateral Entry)**	**MNC**	**Mandatory**	**Non-Credit**	**--**	**50**	**--**	**50**

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

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.

Computer Networks (Theory)

Course Code	15MCA31	Credits	04
Course type	CF	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	100 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the basics of Computer Networks and its applications in fast evolving technological world
2. Exposing the real world applications using Computer Networks
3. Distinguishing different types of networks
4. Studying the different layers in TCP/IP and OSI reference model with their functionalities and services provided in networking
5. Developing an intuitive understanding of the basic networking concepts, protocol design implementation, and performance issues
6. Studying various network services and network management issues
7. Enlightening the dynamic and evolving field of networking which will make them use the networking concepts and its utility in today's fast changing networking environment

Pre-requisites:

1. Basic knowledge of computer and logic building capabilities.
2. Knowledge of data representation and Data Structures

Unit – I **10 Hours**

Introduction:

Uses of Computer Networks, Classification of Computer Networks, Network Hardware, Network Software, Reference Models, Example Networks

Self-learning topics: Network Standardization.

Unit – II **10 Hours**

Physical Layer:

Theoretical Basis for Data Communication, Guided Transmission Media, Wireless Transmission, Digital Modulation and Multiplexing

Self-learning topics: The Mobile Telephone System

Unit – III **11 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.

Self-Learning Topics: Multiple Access Protocols

Unit – IV **11 Hours**

Network Layer:

Network layer design issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, Internetworking, internetworking and The Network Layer in the internet

Unit – V **10 Hours**

Transport Layer and Application Layer:

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

DNS-Domain Name System, Email, Introduction to Streaming Audio and Video

Self learning topics: WWW, Content Delivery

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

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Build** proficient knowledge of computer networking	L 3
2. **Develop** models using Networking Protocols	L 3
3. **Distinguish** between different types of Network topologies	L 4
4. **Evaluate** different performance issues related to networking	L 5
5. **Explain** Functionalities and Working of networking devices	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. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Object Oriented Programming-2 (Java) (Theory)

Course Code	15MCA32	Credits	04
Course type	CC	CIE Marks	50 marks
Hours/week: L-T-P	3-1-0	SEE Marks	100 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing the basics of Java Programming Language
2. Imparting the knowledge of various OOPS concepts and its implementation in Java
3. Educating the key aspects of Java like security, robustness, and platform independence
4. Providing emphasis on the strengths of Java Language like Multithreading, Networking, Generics, Applets, and File handling
5. Understanding how to design and implement standalone applications and to create and handle event-driven GUI using Swing components; and implement I/O functionality to read from and write to text files

Pre-requisites:

1. A course on computer programming language (MCA14).
2. A course on object oriented programming-1 (MCA24).

Unit – I 11 Hours

Introduction to Java, Program Control Statements, arrays and Strings in Java:

The Java Language, Key Attributes of Object-Oriented Programming, The Java Development Kit, Class Libraries. Java's Primitive Types, Literals, Variables, The Scope and Lifetime of Variables, operators, Type conversion in Assignments, Using Cast, Operator Precedence, Expressions, and Input characters from the Keyword.

The basic branching statements, and looping statements, break and continue.

Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, For-Each Style for Loop. String Fundamentals - String, String Buffer.

Self-Learning Topics: String Builder classes

Unit – II 11 Hours

Class Fundamentals, inheritance and interfaces:

Creating Objects and reference Variables. Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, this Keyword. Method Overloading, Overloading Constructors, Recursion, Understanding Static.

Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Method Overriding, Overridden Methods support polymorphism, need for Overridden Methods, Using Abstract Classes, Using final. Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces

Unit – III 11 Hours

Exceptions, IO & file handling in Java:

The Exception Hierarchy, Exception Handling Fundamentals, using Multiple catch clauses, User defined exception - Throwing an Exception, A Closer look at Throwable, using finally.

The Java I/O Classes and Interfaces, File, The Closable and Flushable Interfaces, The Stream Classes, The Byte Streams, The Character Streams, The Console Class, Using Stream I/O.

Self-Learning Topics: Serialization, Stream Benefits.

Unit – IV **11 Hours**

Packages, Multithreaded Programming, Generics:

Package Fundamentals, Packages and Member Access, Importing Packages
Multithreading fundamentals, The Thread Class and Runnable Interface, Creating Thread, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.
Generics Fundamentals, Bounded Types, Generic Methods, Generic Constructors.
Self-Learning Topics: Generic Restrictions

Unit – V **10 Hours**

Applets, Swing Fundamentals and Networking with Java.net:

Applet basics, A complete Applet Skeleton, Applet Initialization and Termination, A key Aspect of an Applet Architecture, Requesting Repainting, using the status window, Passing parameters to Applets.
The origin and Design philosophy of swing, Components and containers, Layout managers,
A first simple swing Example, Event Handling,
Networking fundamentals, The Networking classes and Interfaces, The InetAddress class, The Socket Class, The URL class, The URLConnection Class, The Http, URL Connection Class
Self-learning topics: Exploring Swing Controls-JLabel and ImageIcon, The Swing Buttons, Trees

Books

1. Herbert Schildt, Dale Skrien, Java Fundamentals-A Comprehensive Introduction, Tata McGraw Hill Edition 2013.
2. T V Suresh Kumar, B Eshwara Reddy and P Raghavan, Programming with Java, Sanguine Technical Publishers, 2011
3. Hari Mohan Pandey, Java Programming, Pearson Education, 2012
4. KoGenT, Java 6 Programming, Black Book, dreamtech Press, 2012
5. Y. Daniel Liang, Introduction to Java Programming, Pearson Education, Comprehensive Edition, 2011

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**List** and **demonstrate** the implementation of key features of Object Oriented Programming	L 1, L 2
2.	**Apply** the exceptions handling, multithreading, and file handling mechanisms in software development using Java technology	L 3
3.	**Design** GUI for desktop based applications using swings and Internet based applet applications using Applet/JApplet	L 6
4.	**Develop** network based applications using Networking classes	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 and conduct experiments, analyze and interpret data	**3**
3	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
4	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
7.	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Software Engineering (Theory)

Course Code	15MCA33	Credits	04
Course type	CC	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	100 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of Software Engineering, Software Product Development Phases and its applications in real world
2. Understanding recent trends in Software Engineering like extreme programming and evolutionary methods, Use of Component Based Software Engineering
3. Applying testing techniques, viz. black box and white box testing, testing tools and methodology and analyze modeling techniques
4. Providing the basics of analytical skills to justify planning methodology for software development
5. Extracting information regarding software development, planning, modeling, implementation and testing a software product

Unit – I 12 Hours

Overview & Software Process & Agile Software Development

Introduction: Professional Software Development Attributes of good software, software engineering diversity, IEEE/ ACM code of software engineering ethics, case studies.

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, Agile project management

Self-Learning Topics: , Scaling agile methods

Unit – II 10 Hours

Requirements Engineering, System Modeling, Architectural Design and implementation

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

Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering, Software architecture: the role of software architecture, architectural views, component and connector view, Architectural styles for C&C view, Documenting architectural design. Design: Design concepts, Function oriented design, detailed design, verification, matrix (Complexity matrix for function oriented design)

Unit – III 10 Hours

Component-based software engineering & Distributed Software engineering

Components and component model, CBSE process, Component composition.

Distributed system issues, Client-server computing, Architectural patterns for distributed systems

Self-Learning Topics: Software as a service.

Unit – IV 10 Hours

Planning a software Project

Process planning, Effort estimation, Project scheduling and staffing, Software configuration management plan, Quality plan, Risk Management, Project monitoring plan.

Self-Learning Topics: Generic Restrictions

Unit – V 10 Hours

Software testing

Testing Concepts. Error, Fault, and Failure, Test Case, Test Suite, and Test Harness Psychology of Testing, Levels of Testing, Testing Process Test Plan Test Case Design Test Case Execution, Black-Box Testing, White-Box Testing, Metrics.

Books

1. Ian Sommerville: Software Engineering, 9th edition, Person Education Ltd, 2011
2. Pankaj Jalote: Software engineering, Wiley India Pvt Ltd (2010)
3. Roger S Pressman: Software Engineering-A Practitioners approach, 6th edition, McGraw-Hill, 2010
4. Hans Van Vliet: Software Engineering Principles and Practices, 3rd Edition, Wiley – India, 2010
5. IEEE/ ACM code of software engineering ethics, case studies

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Illustrate** ethical responsibilities of software engineer and e**xtend** IEEE/ ACM code of software engineering ethics with case studies	L 2
2. **Appreciate** Software Process models: Waterfall, Incremental Development, Reuses Oriented, Process Activities; Coping with change, and The rational Unified Process	L 5
3. **Estimate** properties of CBSE	L 5
4. **Assess** risk involved in planning a software project	L 5
5. **Define** Functional and Non-functional requirements and a**nalyze** Software Requirements Document & Requirements Specification	L 1, L 4
6. **Summarize** Requirements Engineering Processes, Requirement Elicitation and Analysis, Requirements Validation, and Requirements Management	L 2
7. **Classify** distributed software engineering methods for client server computing	L 4
8. **Compare** System Models	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**
3. Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4. Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6 Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**

7.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities	**7**
8.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
9.	Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional	**9**
10.	Postgraduates will develop confidence for self education and ability for life-long learning	**10**
11.	Postgraduates will demonstrate research-based knowledge and research methods for addressing current issues in research trends	**12**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Internet Web Programming (Theory)

Course Code	**15MCA34**	**Credits**	04
Course type	**FE**	**CIE Marks**	50 marks
Hours/week: L-T-P	**4-0-0**	**SEE Marks**	100 marks
Total Hours:	**52**	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understanding Advanced Web tools and providing skills required to build and maintain server sites on the web
2. Exploring the wide variety of server side scripting technologies used in the construction of a website
3. Understanding the tools and techniques that may be used for the design and development of dynamic web

Pre-requisites:
Course on Web Programming (MCA12).

Unit – I — 10 Hours

Introduction to jQuery
Introducing jQuery, jQuery fundamentals, Creating the wrapped element set, Bringing pages to life with jQuery, Understanding the browser event models, The jQuery Event Model, Sprucing up with animations and effects

Unit – II — 10 Hours

Introduction to PHP and Building Web applications with PHP:
Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Tracking users, cookies, sessions, Using database
Self-Learning Topics: Handling XML

Unit – III — 10 Hours

Introduction to Ruby and Introduction to Rails
Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterates, Pattern matching. Overview of Rails, Document requests, Processing forms, Layouts. Rails applications with Databases
Self-Learning Topics: File Handling with Ruby

Unit – IV — 10 Hours

Web 2.0 and Web Services:
What is Web 2.0? Folksonomies and Web 2.0, Software as a Service (SaaS), Data and Web 2.0, Convergence, Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking. Web Services: SOAP, RPC Style SOAP, Document style SOAP. WSDL, REST services, JSON format, What is JSON? Array literals, Object literals, Mixing literals, JSON Syntax, JSON Encoding and Decoding.
Self-Learning Topics: JSON versus XML

Unit – V **12 Hours**

D3.js (Data Driven Documents): Data visualization tool for web apps

Introduction to D3: Building a Simple Subway Train Status Board, Graphing Mean Daily Plaza Traffic. Scales, Axes, and Lines, Graphing Turnstile Traffic, Interaction and Transitions, Subway Connectivity, Scheduled Wait Time Distribution

Books

1. Bear bibeault, Yehuda katz: jQuery in Action. 3rd Edn, Dream Tech India,2008
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edn, Wiley India, 2006
3. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008
4. Francis Shanahan: Mashups, Wiley India, 2012
5. Mike Dewar: "Getting Started with D3": O'Reilly Media, 2012

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Describe** several tools and/or techniques involved in developing professional level Websites	L 2
2.	**Recognize** one or more of the tools deemed appropriate for a given task well enough to deploy and utilize those tools in implementing solutions to specific problems and **evaluate** the effectiveness of those solutions	L , L 6
3.	**Demonstrate** an understanding of the web and related delivery systems	L 3
4.	**Demonstrate** an understanding of the role of CGI scripting all aspects of IT	L 3
5.	**Demonstrate** an understanding of the basic principles of Perl programming capabilities	L 3
6.	**Apply** web technology tools effectively in the web development	L 3
7.	**Compare** and **contras**t those tools and/or techniques while analyzing their appropriateness for solving specific problems.	L 4
8.	**Appraise** the importance of PHP and its use as a server side scripting language	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**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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MIS and E- COMMERCE (Theory)

Course Code	**15MCA35**	**Credits**	04
Course type	**FE**	**CIE Marks**	50 marks
Hours/week: L-T-P	**4-0-0**	**SEE Marks**	100 marks
Total Hours:	**52**	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of Management Information Systems in Real world.
2. Representation of the solution in the form of E-commerce application
3. Exploring key challenges in Managing Information
4. Describing Lifecycle Components of Enterprise Resource Planning, Components, and Challenges

Pre-requisites:

A course on software engineering (MCA33).

Unit – I **10 Hours**

Information and Knowledge, Introduction of MIS:

Information concepts, classification of information, methods of data and information collection, value of information, information: A quality product, General model of a human as information processor, Knowledge**.**

MIS: Concept, Definition, Role of the MIS, Impact of MIS, MIS and the user, Management as a control system, MIS support to the management, Management effectiveness and MIS,

Self-Learning Topics: Organization as system. MIS: organization effectiveness.

Unit – II **10 Hours**

Decision Making and DSS, Electronic Business systems:

Decision making concepts; decision making process, decision-making by analytical modeling, Behavioral concepts in decision making, organizational decision-making, Decision structure, DSS components, Management reporting alternatives.

Enterprise business system – Introduction, cross-functional enterprise applications, real world case, Functional business system, - Introduction, marketing systems, sales force automation, CIM, HRM, online accounting system

Self-Learning Topics: Self-Learning Topics:

Customer relationship management, ERP, Supply chain management (real world cases for the above

Unit – III **10 Hours**

Client Server Architecture and E-business Technology, Introduction to E-Commerce:

Client server architecture, implementation strategies, Introduction to E-business, model of E-business, internet and World Wide Web, Intranet/Extranet, Electronic, Impact of Web on

Strategic management, Web enabled business management, MIS in Web environment.

Course overview; Introduction to e-commerce, E-commerce Business Models and Concepts, E=Commerce Infrastructure: The Internet and World Wide Web, Web design, JavaScript Internet Information Server (IIS); Personal Web Server (PWS),

Unit – IV **12 Hours**

E-Commerce techniques and Issues

Introduction to Active Server Pages (ASP), Building an E-Commerce Web Site, E-Commerce Payment Systems, E-Commerce Marketing Techniques, Building product catalogue, Search product catalogue, Web Spider and search agent, Ethical

Self-Learning Topics: Social and Political Issues in E-commerce

Unit – V **10 Hours**

Internet Communication

Transaction Systems, Shopping Carts, XML, E-Commerce Applications: Business-to-Consumer (B2C), Consumer-to-Consumer (C2C), Business-to-Business (B2B), Digital Government, Marketplaces, and Communities, Security and Encryption, Web Security

Books

1. Waman S Jhawadekar: Management Information System, 3rd Edition, Tata McGraw Hill
2. James A O'Brien and George M Marakas: Management Information System, 7th Edition, Tata McGraw Hill, 2006
3. Turban, Rainer, and Potter, Introduction to E-Commerce, second edition, 2003
4. H. M. Deitel, P. J. Deitel and T. R. Nieto, E-Business and E-Commerce: How to Program, Prentice hall, 2001

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Appraise** fundamental knowledge of managing information systems	L 5
2. **Compare** Commerce Techniques and Issues with Internet Communication	L 4
3. **Inspect** the real world enterprise resource planning system development	L 4
4. **Evaluate** development of ecommerce web sites	L 6
5. **Develop** proficient knowledge of supply chain management systems in organization	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 knowledge of professional and ethical responsibilities	**7**
3. Post graduates will develop confidence for self-education and ability for life-long learning	**10**

Course delivery methods	Assessment methods
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Computer Networks Laboratory (Lab)

Course Code	**15MCA36**	**Credits**	**2**
Course type	**CC**	**CIE Marks**	**50**
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	**50**
Total Hours:	**42**	**SEE Duration**	**3 Hours for 50 Marks**

Course learning objectives

1. Providing a clear understanding of network simulators
2. Introducing the basic design and implementation of various types of network topologies
3. Understanding the four major concepts: data communications, networking, protocols and its standards, and networking models
4. Giving an insight of LAN and Wireless LAN with an exposure of using network simulators like NS2 / NS3
5. Using higher programming languages like C/C++ to learn and explore the implementation of error detection codes, routing algorithms, TCP/IP sockets and congestion control mechanisms

Pre-requisites:

Students must have the knowledge of the following topics:

1. Basics of computer systems and Computer Networks.
2. Knowledge of C/ C++ programming constructs and should be able to write basic C / C++ programs.
3. Knowledge of UNIX / Linux Operating system.
4. Data structures

Laboratory Exercises:

SIMULATION EXERCISES

The following experiments shall be conducted using network free and open source software simulators like NS2 / NS3 could be used. If NS2 is used 'tcl' scripting should be introduced. If NS3 is used C++ with PYTHON has to be introduced during first two weeks of the labs:

Implement the following concepts in NS2 / NS3 (6 Experiments) :

Designing a network with various node and line properties and observing the network behavior, Buffer capacity designs, LAN designs, Bottleneck networks, flow and congestion control, Routing algorithms, Wireless mobile experiments.

Assumptions to be made by the student for the TCL programs for the above exercises:
Packet size, bandwidth of a link , propagation delay between the links, packets generated interval time, units for start time and end time of the traffic, packet discard strategy, type of application that uses TCP and UDP and total simulation time

PROGRAMMING EXERCISES

Implement the following concepts in C / C++ (4 Experiments) :

Error detecting codes, Routing algorithms, TCP/IP sockets for client/server program error detection/correction techniques, congestion control algorithms.

NOTE: In the examination, any one problem has to be asked from above EXERCISES. The choice must be based on random selection from the entire lots.

Books

1. "Computer Networks" by Andrew S Tanenbaum, David J Wetheral, 5th Edition, Pearson 2012
2. "Data and Computer Communications" by William Stallings, Above 7th edition, 2004
3. "Computer Networks" Principles, Technologies and Protocols for Network Design, by NATALA OLIFER and VICTOR OLIFER, 2010
4. http://www.isi.edu/nsnam/ns/ns-documentation
5. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
6. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
7. High Performance TCP/IP: Networking Concepts, Issues, and Solutions, Mahbub Hassan and Raj Jain, IST Edition, 2009 PHI Learning

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** and **utilize** NS2 simulator or equivalent simulators	L 2, L 3
2.	**Identify** and **explain** the architecture of network topologies and concepts	L 2, L 3
3.	**Utilize** *Grep* command or *AWK* script to extract features from the trace file to determine the various Networking factors	L 3
4.	**Develop** knowledge to write TCL script, understand linking of nodes, agents, and to connect application protocol on them	L 3
5.	**Construct** Network Simulations using NS2 or equivalent simulators in world scenarios in a project-based approach	L 3
6.	**Analyze** wired and wireless topology with features like trace files, Xgraph, NAM of NS2	L 4
7.	**Analyze** and **design** working of network protocols	L 4, L 6
8.	**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 an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications.	**6**
5.	Post graduates will develop confidence for self education and ability for life-long learning	**10**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Object Oriented Programming-2 (Java) Laboratory (Lab)

Course Code	**15MCA37**	**Credits**	**2**
Course type	**CC**	**CIE Marks**	**50**
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	**50**
Total Hours:	**42**	**SEE Duration**	**3 Hours for 50 Marks**

Course learning objectives

1. Providing a clear understanding of Object Oriented (OO) concepts/philosophy and the major aspects of software development with emphasis to be given on implementing
2. Imparting the knowledge of implementing Object Oriented key concepts like ADT/Encapsulation, Inheritance, Polymorphism etc
3. Providing an insight on designing and developing software with requirements such as multithreading, GUI based applications, and network based
4. Providing a platform for learning advanced features of Java Language

Pre-requisites :

A course on computer programming language (MCA14).

List of experiments

Laboratory Exercises:

The following experiments shall be conducted using JDK latest version using text editor and executed on command prompt. GUI concepts can be implemented using IDE.

Implement 8 programs on the following concepts:

Polymorphism (Overloading and overriding), dynamic method dispatch (interfaces), multithreading and inter-thread communications, multithreading with priorities, packages with member of different access levels, exception handling, File (FileInputStream & FileOutputStream), to handle TCP/IP or Datagram Socket Connection.

Implement 2 programs on the following concepts using IDE:

Applet program with user interactions by Keyboard / mouse and a simple swing GUI interface.

Books

1. Herbert Schildt, Java "The Complete Reference" Eight Edition, Tata McGraw Hill
2. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGraw Hill Edition 2013
3. Programming with Java by T V Suresh Kumar, B Eshwara Reddy and P Raghavan, Sanguine Technical Publishers, 2011

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Apply** built-in Classes like String, Enumerations, Arrays, and Generic Classes etc	L 3
2. **Apply** Object Oriented concepts like Classes, Objects, Inheritance and Polymorphism in software design and development	L 3
3. **Design** and **build** robust systems with event handling and multithreading concepts in problem solving	L 6

4.	**Develop** GUI based systems using applets and Swings components	L 6
5.	**Design** and **develop** network based applications using Network Classes	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 and conduct experiments, analyze and interpret data	**3**
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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50

- Submission and certification of lab journal is compulsory to qualify for SEE.
- **Minimum marks required to qualify for SEE : 25**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Internet Web Programming Laboratory (Lab)

Course Code	**15MCA38**	**Credits**	**2**
Course type	**CC**	**CIE Marks**	**50**
Hours/week: L-T-P	**0-0-1**	**SEE Marks**	**50**
Total Hours:	**42**	**SEE Duration**	**3 Hours for 50 Marks**

Course learning objectives

1. Understanding advanced web tools and inculcating the skills required to build and maintain server sites on the web
2. Exploring a wide variety of technologies used in the construction of website
3. Understanding the tools and techniques that may be used for the design and development of dynamic web

Pre-requisites :

Course on Web Programming (MCA12) and Web Programming Laboratory (MCA17).

List of experiments

Maximum 6 exercise scan be framed on the following topics:

jQuery, PHP, Database access with PHP and mysql, Ruby on Rails applications,

Mini Project:

Develop a web application project using the languages and concepts learnt in the theory with a good look and feel effects. Student can use any web technologies and frameworks and databases.

Coding Practice

1. Use of Good Programming practices: Declaration of variables, Indentation, Documentation, Simplicity of logic, Efficiency of logic, uniformity etc.
2. Generic and Reusable code.
3. Inclusions of exceptional cases. Better usability
4. Building web applications with Perl, PHP.

Note:

1. A team of maximum two students must develop the mini project. However, during the examination, each student must demonstrate the project individually.
2. The team must submit a brief project report (25-30 pages) that must include the following
    a. Introduction
    b. Requirement Analysis
    c. Software Requirement Specification
    d. Analysis and Design
    e. Implementation
    f. Testing Conclusion
    g. References
3. The report must be evaluated for 10 Marks. Demonstration and Viva for 15 Marks.

Instructions:

1. In the examination, one exercise out of 5 to be asked for 25 marks.
2. The mini project has to be evaluated for 25 marks.

Project report duly signed by the Guide need to be submitted during the examination.

Books

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

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Describe** several tools and/or techniques involved in developing Professional Level Web sites	L 2
2.	**Demonstrate** an understanding of the web and related delivery systems	L 3
3.	**Demonstrate** an understanding of the role of CGI scripting in aspects of IT	L 3
4.	**Apply** web technology tools effectively in the web development	L 3
5.	**Demonstrate** an understanding of the basic principles of Perl programming capabilities	L 3
6.	**Compare** and **contrast** the tools and/or techniques by analyzing their appropriateness for solving specific problems	L 4
7.	**Recognize** one or more of the tools deemed appropriate for a given task well enough to deploy and utilize those tools in implementing solutions to specific problems; and evaluate the effectiveness of those solutions	L 1, L 6
8.	**Appraise** the importance of PHP and its use as a server side scripting language	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**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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AUDIT COURSE (Theory)

Course Code	**15MCA39**	**Credits**	NIL
Course type	**MNC**	**CIE Marks**	50 marks
Hours/week: L-T-P	**--**	**SEE Marks**	--
Total Hours:	**--**	**SEE Duration**	--

Course learning objectives

1. Providing knowledge of fundamentals of DM, DS, OOP, DBMS & SP

Pre-requisites:

Basic knowledge of related topics

Unit – I **10 Hours**

Fundamentals of Discrete Mathematics

Basic Connectives and Truth Tables, Logic Equivalence: The laws of Logic, Logical Implications: Rules of Inference, The use of Quantifiers, Quantifier Definitions, and Proofs of theorems.
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 – II **8 Hours**

Essentials of Data structures: Pointers**,** structures**,** 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 sorts. Tree Searching: Insertion into a Binary search tree, Deleting from a BST

Unit – III **10 Hours**

Essentials of DBMS: Characteristics of Database approach; Actors on the screen; Data models, schemas and instances; Three-schema architecture and data independence; 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, 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;

Relational Algebra: Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping

Unit – IV **8 Hours**

Fundamentals of OOP: Introduction to Class specification, Class Objects, access members, defining member functions, data hiding, constructors, destructors, parameterized constructors, static data members, functions, passing objects as arguments, returning objects, friend functions & classes, arrays of objects, Dynamic objects – Pointers to objects. function overloading, recursive functions, function templates and Class templates, Operator overloading using friend functions such as ++, --, [] etc. Base Class, Types of Inheritance, Inheritance & protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors & Inheritance. Passing parameters to base Class Constructors, Granting access, Virtual base classes, Virtual function, pure virtual functions, abstract classes, exception handling

Unit – V **9 Hours**

Essentials of SP: 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, Basic Loader Functions, Language processors, The structure of a compiler

Books

1. Kolman, Busby, Ross "Discrete Mathematical Structures", 6th Edition Prentice Hall of India, 2010
2. Yedidyah Langsam and Moshe J.Augenstein and Aaron M. Tenanbaum, Data structures using C , PHI. Reference books
3. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007
4. Herbert Schildt, C++ The Complete Reference, 4th Edition, Tata McGraw Hill, 2007
5. D.M.Dhamdhere: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999
6. 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. **Analyze** set theory and operations	L 1, L 2
2. **Analyze & implement** searching and sorting techniques	L 4
3. **Access**, **analyze** and **construct** various operations on classes objects and related operations on data	L 4, L 5, L6
4. **Define and analyze** data models and operations on it	L 1, L 4
5. **Appraise** & **analyze**	L 4, L 5, 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 demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6	Postgraduates will develop confidence for self-education and ability for life-long learning	**10**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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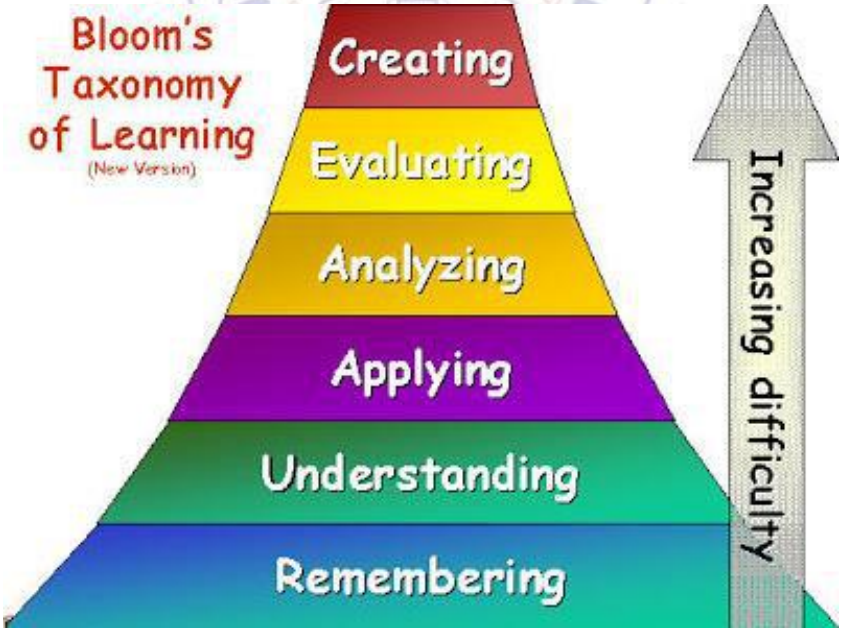
Bloom's Taxonomy of Learning Objectives

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

IV Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours	CIE Marks	SEE Marks	Total Marks
1	15MCA41	Anlysis and Design of Algorithms	CC	3-1-0	4	5	50	50	100
2	15MCA42	Topics in Enterprise Architecture-1 (J2EE)	CC	4-0-0	4	4	50	50	100
3	15MCA43	Computer Graphics and Visualization	CC	3-1-0	4	5	50	50	100
4	15MCA44X	Elective – 1	GE	4-0-0	4	4	50	50	100
5	15MCA45X	Elective – 2	GE	4-0-0	4	4	50	50	100
6	15MCA46	Algorithms Laboratory	CC	0-0-1	2	3	50	50	100
7	15MCA47	Topics in Enterprise Architecture-1 Laboratory (J2EE)	CC	0-0-1	2	3	50	50	100
8	15MCA48	Computer Graphics Laboratory	CC	0-0-1	2	3	50	50	100
9	15MCA49	Communicative English	CF	2-0-0	2	1	50	--	50
			Total	**20-2-3**	**28**	**32**	**450**	**400**	**850**

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

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-1 and Elective-2 respectively.

Elective Group-1

Sl. No.	Course Code	Course Title
1	441	Advanced Database Management Systems
2	442	UNIX System Programming
3	443	Cloud Computing
4	444	Advanced Computer Networks
5	445	Software Testing
6	446	Enterprise Resource Planning
7	447	Operations Research

Elective Group-2

Sl. No.	Course Code	Course Title
1	451	Big Data Analytics
2	452	Finite Automata and Formal Languages
3	453	Software Architecture
4	454	Mobile Applications
5	455	Client-Server Computing
6	456	Principles of User Interface Design
7	457	Mobile Computing

Analysis and Design of Algorithms (Theory)

Course Code	15MCA41	Credits	04
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	3-1-0	SEE Marks	50 Marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Getting a clear understanding of algorithms.
2. Understanding concepts of parallel programming
3. Designing algorithms, manipulating algorithms, understanding algorithms, analyzing algorithms, comparing algorithms, and appreciating the working of an efficient algorithm
4. Focusing on the limitations of algorithmic power and how this limitation can be coped up by using design techniques like backtracking and branch-and-bound, and finally concludes with a discussion of few approximation algorithms
5 Developing analytical skills and problem-solving skills

Pre-requisites :

1. A basic knowledge of mathematics including mathematical induction.
2. Knowledge of graph theory

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, Introduction to divide and conquer technique, Merge Sort, Quick Sort, Binary Search, multiplication of large integers, Strassen's Matrix Multiplication.
Self learning topics: Exhaustive Search for Travelling Salesman Problem, Knapsack Problem and Assignment Problem.

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, Hashing.
Self learning topics: Johnson-Trotter algorithm for generating combinatorial objects.

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
Self learning topics: Approximation algorithms for NP hard problems

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.	**Discuss** the general framework for analyzing algorithm efficiency.	L1
2.	**Discuss** general method to solve problems like Knapsack and Job sequencing with Deadlines	L1
3.	**Discuss** and **apply** different strategies for searching and sorting the elements in given list	L1, L3
4	**Apply** 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 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**
4	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5	Postgraduates can participate and succeed in competitive examinations	**11**

Course delivery methods	**Assessment methods**
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Topics in Enterprise Architecture-1 (J2EE) (Theory)

Course Code	15MCA42	Credits	04
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 Marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Understanding the core components of advanced Java programming language like JSP, Servlets, JDBC, Java Beans and EJB
2. Understanding the core components of Advanced Java technologies
3. Understanding and implementing Servlet life cycle and handling request headers, response headers, and status codes in servlets
4. Understanding JSP and life cycle of JSP with the advantages of JSP and make use of action tags, implicit objects, directive tags, and scriplet tags
5. Exploring JAR file and implementation of Annotations
6. Understanding Java Beans and API
7. Exploring database connectivity using JDBC connection API
8. Understanding types of EJB's, life cycle of Server Side and Client Side EJB components

Pre-requisites: A course on Java Programming (15MCA32) and basic programming Skills

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

Self learning topics: Servlet API

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, scriplet 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, is Elignore attribute, buffer and auto flush attributes, info attribute, errorPage and is errorPage attributes, is Thread safe Attribute, extends attribute, language attribute, Including files and applets in jsp Pages, using java beans components in JSP documents.

Java Beans and Annotations

Java Beans, advantages java beans, properties of beans, java bean API, Creating Packages, Interfaces, JAR files and Annotations. The core java API package, New java. Lang Sub package, Built-in Annotations

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

Self learning topics:JDBC API, Stored procedure and stored function in DBMS

Unit – V **10 Hours**

Introduction to EJB and Server side Components Model

The Problem domain, Breakup responsibilities, CodeSmart not hard, the Enterprise java bean specification. Components Types. Server Side Component Types, Session Beans, Stateful Session Bean, Stateless Session bean, Singleton Session bean, MessageDriven Beans, Entity Beans, The Java Persistence Model. Container services. Dependency Injection, Concurrency, Instance pooling n caching, Transactions, security, Timers, Naming and object stores, Interoperability, Life Cycle Callbacks, Interceptors, platform integration

Self learning topics:MVC (Model View Controller) Architecture

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. Michael Sikora, EJB 3 Developer Guide, A practical guide for developers and architects to the Enterprise Java Beans Standard, Shroff Publishers & Distributors PVT LTD. July 2008
6. Web Technologies: Html, Javascrip,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 Related aspects through Servlets and Java Server Pages	L2, L3
2.	**Develop** Applications, which are distributed in nature like banking applications through EJB	L2, L3
3.	**Demonstrate** comprehension in fundamental topics of computing, including the intellectual core of computing, software design and development, algorithms, computer organization and architecture, and software systems	L3
4.	**Develop** many applications using JDBC to connect to a Database	L2, 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 design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
4	Postgraduates will demonstrate an ability to analyze and build computer	**5**

	applications for multiple domains	
5	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
7	Postgraduates can participate and succeed in competitive examinations	**11**

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Computer Graphics and Visualization (Theory)

Course Code	15MCA43	Credits	04
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	3-1-0	SEE Marks	50 Marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of computer graphics to give hands-on experience at developing interactive, real-time graphics applications using OpenGL
2. Familiarizing with tools that open up a whole new world of 3D visualization
3. Understanding all aspects of computer graphics such as writing application programs that generate graphical output
4. Understanding how the underlying graphics library and the hardware are implemented

Pre-requisites : Basic Mathematics and Geometrical concepts.
A course on computer programming (15MCA14) and Object oriented programming-1 (15MCA24)

Unit – I **10 Hours**

Introduction and Line Generation:
Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, , Ellipse generation algorithms, Fill area primitives, Polygon fill areas, OpenGL polygon fill area functions, General scan line polygon fill algorithm, Fill methods for areas with irregular boundaries

Unit – II **10 Hours**

Introduction to OpenGL:
Introduction to OpenGL, Coordinate reference frames, Specifying two dimensional world coordinate reference frame in OpenGL, OpenGL point functions, OpenGL line functions, OpenGL fill area attribute functions

Unit – III **10 Hours**

Two Dimensional Transformations:
Basic transformation, Matrix representations and homogenous coordinates, composite transformations, Reflections and shearing, Affine transformations, OpenGL geometric transformation functions. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as CohenSutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non-rectangular clip windows; Polygon clipping –Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.

Unit – IV **12 Hours**

Three Dimensional Transformations:
3-D geometric primitives, 3-D Object representation, 3-D Transformation, The three dimensional viewing concepts, Three dimensional viewing pipeline, Three dimensional viewing coordinate parameters, Transformation from world to viewing coordinates, 3-D Clipping
Self-learning topics: Curves

Unit – V **10 Hours**

Projections, Surfaces and Computer Animation:

Projections Transformations, Hierarchy of Projections Transformations, Types of Parallel Projections Transformations, Types of Perspective Projections Transformations, Visible Surface Detection Methods: Back Face Detection, Depth buffer method. Raster methods for computer animation, Design of animation sequences, Traditional animation techniques, General computer animation functions, Advantages of computer animation

Self-learning topics: Rendering, Animation using user interactions

Books

1. Donald Hearn, M. Pauline Baker,' Computer Graphics with Open GL', Pearson (Indian Edition), Third Edition
2. Edward Angel, 'Interactive Computer Graphics – A top down approach using Open GL', Pearson, Fifth Edition
3. Peter Shirley, Steve Marschner, 'Computer Graphics, Cengage Learning (Indian edition),2009
4. James D Foley, Van Dam, S K Feiner and John f Hughes, "Computer Graphics Principles and Practice" Second Edition in C

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify and explain the structure of OpenGL-API and describe the abstractions of OpenGL-API and demonstrate its use by writing simple 2D and 3D graphics applications that do not require user interaction	L2, L3
2.	Classify the views used in classical viewing and demonstrate the techniques of computer viewing in application programs using functionalities of OpenGL	L2
3.	Illustrate the different Clip lines views and demonstrate the technique of Clip lines algorithm in application programs using functionalities of OpenGL	L2
4.	Identify the various applications of computer graphics and discuss the working of graphics system and its analogy with physical imaging systems. Identify the different graphics architectures	L3, L6
5.	Construct a simple 2D graphics program using minimal OpenGL-API	L6
6.	Illustrate the basic tools of user interaction and animation defined in OpenGL-API	L2
7.	Design and develop simple interactive and animating graphics programs using the tools available in OpenGL-API	L6
8.	Demonstrate the mathematical abstractions of geometric objects and their graphical representations. Evaluate the mathematical abstractions for applying transformations on objects. Design, develop and implement the graphics application programs involving transformations using OpenGL-API	L2, L5, L6
9.	Construct the algorithms of graphics pipeline and the basic implementation strategies used in OpenGL	L6

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

Course delivery methods	Assessment methods
1. **Lecture**	1. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Videos**	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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Algorithms Laboratory (Lab)

Course Code	15MCA46	Credits	02
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	0-0-1	SEE Marks	50 Marks
Total Hours:	42	SEE Duration	3 Hours for 50 marks

Course learning objectives

1. Understanding 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. Exploring 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. Finding means to develop analytical skills and problem-solving skills

Pre-requisites :A course on Computer programming language (15MCA14).
Knowledge of basic mathematics and Graph Theory

Laboratory Exercises

Maximum 10 programs can be framed n the following concepts/strategies:
Recursion, Divide and conquer, Decrease and Conquer, Dynamic Programming, Backtracking, String matching, 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. **Explain** the fundamentals of algorithmic problem solving	L2
2. **Explain** and **analyze** any given problem to derive at a best solution	L2, L3
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 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**

4	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5	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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Topics in Enterprise Architecture-1 Laboratory (Lab)

Course Code	15MCA47	**Credits**	02
Course type	CC	**CIE Marks**	50 Marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 Marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Understanding the importance of Java and Advanced Java technologies
2. Developing knowledge of distributed applications using advanced server side programming like JSP, Servlet, and Java Beans
3. Understanding the need and importance of NetBeans IDE to write, debug and execute Servlets, Server Pages, and EJB applications
4. Getting knowledge about Development of real time enterprise applications for any business purpose which will be very secure in nature

Pre-requisites: A course on Java programming language (MCA32)

Laboratory Exercises

Maximum 10 experiments can be framed on the following topics:
Servlet life Cycle, handling data from client(Client request), Servlet HTTP request Header. (Get () and Post() methods), Servlet cookies, JSP Scripting tags, All attributes of JSP Page directive tag, JSP Action tags(JSP: include, JSP: forward), JSP Using Java Bean class, JDBC.(Java Database Connectivity), JSP directive tags. (include, Page, taglib), EJB Application demonstrating Session Bean.
Note: Net beans IDE (Latest version), Specific/Generalized JAR files, Eclipse IDE may be used.

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. Michael Sikora, EJB 3 Developer Guide, A practical guide for developers and architects to the Enterprise Java Beans Standard, Shroff Publishers & Distributors PVT LTD. July 2008
6. Web Technologies: Html, Javascrip,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. **Write** Applications in JSP and Servlets using NetBeans IDE	L3
2. **Develop** and deploy Web Services on the Java platform	L5
3. **Build** enterprise/distributed applications and systems using J2EE and J2SE in an enterprise/distributed environment	L3
4. **Develop** and **implement** web related aspects using Servlets and JSP	L5

5.	**Develop** GUI based applications using Applet Components	L5

	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 design a system, component or process as per needs and specifications	**4**
4.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
7.	Post graduates can participate and succeed in competitive examinations	**11**

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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Computer Graphics Laboratory (Lab)

Course Code	**15MCA48**	**Credits**	02
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Providing a clear understanding of the structure of OpenGL-API and its interface
2. Emphasizing on the syntax of graphics functions available from OpenGL library and to introduce the GLUT (Graphics Library Utility Toolkit) of OpenGL
3. Making the students acquainted with most common library functions of OpenGL for designing the graphics application programs
4. Gaining the in-depth knowledge of using the graphics functions of OpenGL and to design, develop, and execute the graphics programs using 'C/C++' language under Windows XP operating system
5. Understanding the techniques of designing and developing the graphics programs from the major topics of computer graphics involving both 2D and 3D objects

Pre-requisites: Basic Mathematics and Geometrical concepts.
A course on computer programming (15MCA14) and Object oriented programming-1

Laboratory Exercise

Maximum 10 experiments can be framed on the following topics:
OpenGL functions, graphics output primitive algorithms, boundary fill algorithm, 2D transformation, Clipping, 3D transformation, animation.

Books

1. Jackie Neider, Tom Davis, and Mason Woo, 'OpenGL Programming Guide' Addison-Wesley Publishing Company
2. Donald Hearn, M. Pauline Baker,' Computer Graphics with Open GL', Pearson (Indian Edition), Third Edition
3. Edward Angel, 'Interactive Computer Graphics – A top down approach using Open GL', Pearson, Fifth Edition
4. Peter Shirley, Steve Marschner, 'Computer Graphics, Cengage Learning (Indian edition),2009
5. James D Foley, Van Dam, S K Feiner and John f Hughes, "Computer Graphics Principles and Practice" Second Edition in C

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Demonstrate** the use of OpenGL line and circle drawing functions	L2
2. **Analyze** the construction and display of animated object	L4
3. **Construct** a graphic program in building simple 2D object transformation	L6
4. **Develop** a basic graphics program using commonly used functions of OpenGL-API	L6
5. **Design** a graphics program in building simple 3D objects transformation	L6
6. **Construct** a graphic program for boundary fill algorithm	L6

7.	**Propose** the construction and display of clipping algorithm	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 an ability to analyze and build computer applications for multiple domains	**5**
4.	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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Communicative English (Theory)

Course Code	15MCA49	Credits	02
Course type	CF	CIE Marks	50 Marks
Hours/week: L-T-P	2-0-0	SEE Marks	--
Total Hours:	30	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.
- Ability to frame sentence in English.

Unit – I: Grammar and Vocabulary — 5 Hours

1. Frame grammatically acceptable sentences.
2. Use every day words / commonly used words.

Self-learning topics: Improve their vocabulary by reading

Unit – II: Reading Skills — 5 Hours

1. Comprehend and interpret the texts (passages, charts etc).
2. Use work place / business vocabulary.

Self-learning topics: Solve reading assignments from Cambridge BEC book.

Unit – III: Listening Skills — 7 Hours

1. Interpret recorded audio-video scripts.
2. Make use of words and phrases related to people and the world.

Self-learning topics: Solve listening exercises from www.cambridge.org

Unit – IV: Speaking Skills — 8 Hours

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

Self-learning topics: Self-evaluation by recording their speech

Unit – V: Writing Skills — 5 Hours

1. Write informative, analytical and persuasive essays.
2. Write formal communication.

Self-learning topics: Practice e-mail, memos, and report writing

Books

1. Prof. M.B. Kudari, "Passage to English" Self-Publication, Gokak, 2011.
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. Norman Whitby, "Cambridge English Business Benchmark", Cambridge University Press, 3rd Printing 2014.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. ***Define*** various grammatical concepts such as Articles, Prepositions, Subject-Verb Agreement, and Tenses.	L1
2. ***Explain*** their ideas in their own words in English.	L2
3. ***Interpret*** the given information or data in the form of reading or listening materials.	L3
4. ***Distinguish*** among the various grammatical concepts like sentence patterns, sub-verb agreement, tenses etc.	L4
5. ***Evaluate*** the grammatically acceptable sentences, and ***Defend*** their view-points.	L5
6. ***Design*** and ***Formulate*** oral and written presentations.	L6

Program Outcome of this course (POs)	PO No.
1. It will help them to enhance their communicative skills.	PO8
2. It will help to enhance their ability to work in a group.	PO7, PO9
3. It will encourage them to interact confidently and effectively.	PO11
4. It will promote self-learning.	PO10

Course delivery methods	Assessment methods
1. Lecture	1. Individual speech
2. Learnsoft Software	2. PPT (Group activity)
3. PPT	3. Writing assignment
4. Vocabulary activities/games	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 (25)	5	15	10	5	15	50

Continuous Internal Evaluation (CIE) is of 50 marks. It will be reduced to 25 marks for the calculation of SGPA and CGPA.

Elective Group-1

Advanced Database Management Systems

Course Code	15MCA441	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of advanced topics and techniques in database systems, with a focus on the system and algorithmic aspects
2. Acquiring knowledge about advanced database with the concepts of storage, indexing, transaction management, structure, relational operators and query optimization
3. Emphasizing on survey of recent development and progress in selected areas. Topics include: query optimization, multimedia and time-series data management

Pre-requisites:

1. A course on Operating systems (15MCA23).
2. A course on Database management system (15MCA22).

Unit – I **12 Hours**

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 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 **10 Hours**

Tree Structured Indexing and Hash-Based Indexing:

Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ tress in practice Hash-Based Indexing: Static hashing, Extendible hashing, Linear hashing, comparisons

Unit – III **10 Hours**

Overview of Query Evaluation and External Sorting:

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. DBMS sort data, A simple two-way merge sort; External merge sort

Unit – IV **10 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; Nested sub-

queries; other approaches to query optimization

Unit – V **10 Hours**

Physical Database Design and Tuning:
Introduction; Guidelines for index selection, examples; 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. More Recent Applications
Self-learning topics: Comparative study with different DBMS architecture

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.	**Explain** the fundamental storage concepts, architecture and features of space management	L 2
2.	**Interpret** and **summarize** the large volume data with its design and performance tuning	L 2
3.	**Analyze** the concepts of query evaluation, external sorting and relational operators	L 4
4.	**Analyze** the different indexing structures and **evaluate** it	L 4, L 5
5.	**Assess** the transaction management concepts and recovery techniques	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 identify, formulate and solve engineering problems	**2**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5.	Postgraduates can participate and succeed in competitive examinations.	**11**

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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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UNIX System Programming

Course Code	15MCA442	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of developing complex system-level software in C programming language while gaining an intimate understanding of the UNIX operating system and its programming environment
2. Exploring the aspects of user/kernel interface, fundamental concepts of UNIX, user authentication, basic and advanced I/O, file systems, signals, process relationships
3. Providing the concepts of inter-process communication, software development and maintenance on UNIX systems

Pre-requisites:

1. UNIX and shell Programming (15MCA11)
2. Programming in C / C++ (15MCA14 / 15MCA24)
3. Operating systems (15MCA23).

Unit – I **10 Hours**

Introduction to Unix system Programming:
UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

Unit – II **11 Hours**

UNIX Files and APIs:
File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.

Unit – III **10 Hours**

UNIX Processes:
The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimitFunctions, UNIX Kernel Support for Processes.

Unit – IV **11 Hours**

Process Control and Relationships:
Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times. Introduction to process relationships, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions.
Self-learning topics: Job Control, Orphaned Process Groups.

Unit – V **___Hours**

Signals and Daemon Processes:
The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes- Introduction, Daemon Characteristics, Coding Rules, Error Logging.
Self-learning topics: Client-Server Model.

Books

1. W. Richard Stevens, Stephen A. Rago," Advanced Programming in the UNIX Environment", 2nd Edition,Addison-Wesley, 2005
2. Terrence Chan," Unix System Programming Using C++", Prentice Hall India, 1999
3. Maurice.J.Bach," The Design of the UNIX Operating System", 3rd Edition, Prentice Hall of India

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the role of systems programming and standardization	L 2
2. **Demonstrate** the use of Unix system calls	L 2
3. **Discuss** how UNIX supports Unix file system, Process and process control	L 6
4. **Illustrate** Unix Signals and Daemon Processes	L 2

	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 be able to communicate effectively in both verbal and written form	**8**
4.	Postgraduates will develop confidence for self-education and ability for life-long learning	**10**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Cloud Computing

Course Code	15MCA443	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing hands on experience solving relevant problems
2. Developing the skills needed to become a practitioner or carry out research projects in this domain
3. Developing working experience cloud storage technologies
4. Learning I/O virtualization techniques that serve in offering software, computation and storage services on the cloud
5. Understanding the details of the MapReduce programming model

Pre-requisites:

1. Operating Systems (15MCA23)
2. Networks (15MCA31)
3. Knowledge of Virtualization

Unit – I **10 Hours**

Distributed System Models and Enabling Technologies

Scalable Computing Service over the Internet: The Age of Internet Computing, scalable computing Trends and New Paradigms, Internet of Things and Cyber-Physical Systems. System Models for Distributed and Cloud Computing: Clusters of Cooperative Computers, Grid Computing Infrastructures, Peer-to-Peer Network Families, Cloud Computing over the Internet. Software Environments for Distributed Systems and Clouds: Service-Oriented Architecture (SOA), Trends towards Distributed Operating Systems, Parallel and Distributed Programming Models. Performance, Security, and Energy-Efficiency: Performance Metrics and Scalability Analysis, Fault-Tolerance and System Availability, Network Threats and Data Integrity, Energy-Efficiency in Distributed Computing

Unit – II **10 Hours**

Computer Clusters for scalable parallel computing

Clustering for massive parallelism: Cluster Development Trends, Design Objective of Computer Clusters, Fundamental Cluster Design issues. Virtual machines and Virtualization of clusters and Data centers: Implementation levels of virtualization: levels of virtualization Implementation, VMM Design requirements and providers, Virtualization support at the OS level, Middleware Support for Virtualization.

Cloud Platform Architecture over Virtualized Data Centers

Cloud computing and Service Models: Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as- a- Service (IaaS), Platform- and Software-as-a-Service (Paas, SaaS). Architectural Design of Compute and Storage Clouds: A Generic Cloud architecture Design, Layered Cloud Architectural development, Virtualization Support and Disaster Recovery, Architectural Design Challenges.

Self-learning topics: Study of Hypervisors

Unit – III **10 Hours**

Public Cloud Platforms

GAE, AWS, and Azure: Smart Cloud, Public Clouds and Service Offerings, Google App Engine (GAE), Amazon Web Service (AWS), Microsoft Windows Azure. Inter-cloud Resource

Management: Extended Cloud Computing Services, Resource Provisioning and Platform Deployment, Virtual Machine Creation and Management. Cloud Security and Trust management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques.

Cloud Programming and Software Environments

Features of Cloud and Grid Platforms: Cloud Capabilities and Platform Features, Traditional Features Common to Grids and Clouds, Data Features and Databases, Programming and Runtime Support. Parallel and Distributed Programming Paradigms: Parallel Computing and Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache.

Unit – IV **10 Hours**

Programming Support of App Engine

Programming the Google App Engine, Google File System (GFS), Bigtable, Google's NOSQL system, Chubby, Google's Distributed Lock service. Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service S3, Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure programming support. Emerging Cloud Software Environments: Open Source Eucalyptus and Nimbus, Open Nebula, Sector/Sphere, and OpenStack, Manjrasoft Aneka Cloud and Appliances

Unit – V **10 Hours**

Ubiquitous Clouds and the Internet of Things

Performance of Distributed Systems and the Cloud Data-intensive Scalable Computing (DISC), Quality of Service in Cloud computing, Benchmarking MPI, Azure, EC2, MapReduce, and Hadoop. 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.

Self-learning topics: News and Alert Services.

Books

1. Kai Hwang, Jack Dungaree, and Geoffrey Fox: Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012. Chapters – 1,2,3,4,5,6,9
2. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.
3. Anthony T. Volte, Toby J. Volte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Compare** the operation, implementation and performance of cloud computing systems, and the relative merits and suitability of each for complex data-intensive applications	L 4
2.	**Explain** and **categorize** different cloud computing models, namely, infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS)	L 2, L 4
3.	**Identify** security implications in cloud computing	L 3
4.	**Analyze** the trade-offs inherent in Cloud Computing	L 4
5.	**Compare,contrast,** and **evaluate** the key trade-offs between multiple approaches to cloud system design	L 4, L 5
6.	**Identify** appropriate design choices when solving real-world cloud computing problems	L 3
7.	**Compose** comprehensive case studies analyzing and contrasting different cloud computing solutions	L 6
8.	**Develop** recommendations on cloud computing solutions for an enterprise	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 will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5.	Postgraduates will demonstrate research-based knowledge and research methods for addressing current issues in research trends	**12**

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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Advanced Computer Networks

Course Code	**15MCA444**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of key features of TCP/IP protocols used to explain many performance issues
2. Understanding the Coverage of the tools and techniques for performance evaluation of TCP/IP networks
3. Studying simulation techniques and discussing one popular simulation tool ns
4. Examining the performance concepts and issues for running TCP/IP in the emerging networking environment like wireless networks, mobile networks and satellite networks
5. Understanding congestion control algorithms
6. Discussing various TCP flavors and examining the new queue management schemes proposed for the network routers to combat congestion in highly dynamic environment
7. Summarizing critical performance issues for TCP implementation in end systems

Pre-requisites:

1. Computer networks course (**MCA31)**.
2. Background in system programming (**MCA25)**, statistics and probability are helpful.

UNIT-I 11 Hours

Introduction, Fundamentals and Performance Measurement of TCP/IP Networks:
History of TCP/IP, TCP Applications and Services, Performance Study of TCP/IP. TCP, UDP and IP fundamentals. Performance measurement of TCP/IP networks.

UNIT-II 10 Hours

TCP/IP Network Simulation and TCP Modeling:
The Role of Simulation, Steps of a Systematic Simulation Study, Types of Simulations,
Simulation Validation and Verification, Confidence Level of Simulation Results, Simulation with Self-Similar Traffic, The 'ns' Network Simulator. Motivation for Mathematical Modeling of TCP, Essentials of TCP Modeling.
Self-Learning Topics: Study of different TCP models.

UNIT-III 10 Hours

TCP/IP Performance over Wireless Networks and TCP/IP Performance over Mobile Networks:
Wireless Networks, TCP Performance Issues over Wireless Links, Improving TCP Performance over Wireless Links. Wireless System Evolution and TCP/IP. Cellular and Ad Hoc Networks, TCP Performance in Cellular Networks.
Self-Learning Topics: TCP Performance in Ad Hoc Networks.

UNIT-IV 11 Hours

New TCP Standards and Flavors, Active Queue Management in TCP/IP Networks and TCP Implementation: Duplicate Acknowledgments and Fast Retransmit, Fast Recovery and TCP Reno, TCP NewReno, TCP with Selective Acknowledgments, Forward Acknowledgments, TCP Vegas, Overview of Other Features and Options.
Passive Queue Management, Active Queue Management. TCP Implementation Overview, High

Performance TCP.
Self-Learning Topics: Performance Comparison of TCP Flavors.

UNIT-V **10 Hours**

Introduction to Internet of Things

Internet of Things Common Definition, IoT Strategic Research and Innovation Directions, IoT Smart-X Applications, Network and Communication.

Books

1. High Performance TCP/IP: Networking Concepts, Issues, and Solutions, Mahbub Hassan and Raj Jain, IST Edition, 2009 PHI Learning
2. TCP/IP Illustrated (Volume I, Volume II and Volume III), W. Richard Stevens, Addison-Wesley
3. 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. **Explain** the types of tools available for performance measurement of TCP/IP Networks	L 2
2. **Interpret** and **Examine** advanced and emerging networking technologies	L 2, L 4
3. **Apply** skills to do advanced networking research and programming	L 3
4. **Appraise** the metrics used for performance evaluation of TCP/IP networks	L 5
5. **Elaborate** protocol details of TCP necessary to ensure reliable data transfer over unreliable networks	L 6

Program Outcome of this course (POs)	**PO No.**
1. Post graduates 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. Post graduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
4. Post graduates will develop confidence for self-education and ability for life-long Learning	**10**

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Software Testing

Course Code	15MCA445	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of problem domain, Analyze and design different test cases for testing various types of system software and application software
2. Introducing the basics of software testing, finding problems in any computer program, planning and effective test approach, reporting findings etc
3. Explaining various approaches, techniques, technologies, and methodologies used in software testing and quality assurance
4. Exhibiting the Software Testing skills for analysis, testing using modern tools and technologies within or outside discipline
5. Analyzing different approaches to software testing and quality assurance
6. Selecting optimal solutions for different situations and projects

Pre-requisites:

1. A course on Computer programming language (15MCA14).
2. A course on software engineering (15MCA33).

Unit – I 12 Hours

Basics of Software Testing and Principles, Test case selection, Adequacy

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates. Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing Criteria.

Self-learning topics: Case study for a given problem to explore the software quality, input domain and construction of test cases. Carry out the static testing and perform the defect management analysis.

Unit – II 12 Hours

A perspective on Testing, Examples and Boundary value testing, Equivalence class testing, Decision table based testing

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudocode, The triangle problem, the NextDate function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper. Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, NextDate function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem

Self-learning topics: Practical implementation of the testing methods studied by taking any open source software for the examples studied

Unit – III 10 Hours

Path Testing, Data flow testing and Levels of Testing, Integration Testing

DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition/Use testing, Slice based testing, Guidelines and observations. Traditional view of testing levels, Alternative life cycle models, the SATM systems, Separating integration and system testing, Guidelines and observations. Decomposition based integration, Call graph-based integration, Path based integration

Self-learning topics:

1. Case study to find out the cyclomatic complexity, DD path, set of basis path, McCabe's concept of flipping for nodes with outdegree greater than or equal to 3 for the real world examples.
2. Case study of a program to perform the different types of integration methods.

Unit – IV **10 Hours**

Fault Based Testing

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs specific Scaffolding, Test Oracles, Self-checks as oracles, Capture and Replay

Self-learning topics: Study and analysis of different assumptions in fault based testing, the method of scaffolding.

Unit – V **8 Hours**

Planning and Monitoring the Process, Documenting Analysis and Test

Quality and Process, Test and Analysis strategies and plans, Risk Planning, Monitoring the Process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports

Self-learning topics: Preparation and organization of different types of documentation, technical writing and project reports

Books

1. AdithyaP.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011
2. MauroPezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012
3. Paul C Jourgensen, "Software Testing A Craftmans Approach", Aueredach publications, 3rd edition, 2011

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** Test cases, Error and fault taxonomies, Levels of testing	L 3
2.	**Classify** Boundary Value Testing, Equivalence Class Testing and Decision Table-Based Testing	L 4
3.	**Determine** Alternative life-cycle models, recognize Basic concepts for requirements specification, assess context of interaction	L 5
4.	**List** and **analyze** approaches for Test Execution: from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding	L1, L 4
5.	**Identify** analysis strategies and plans, to Test design specifications documents, to Test and analysis reports	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 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**
4.	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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Enterprise Resource Planning

Course Code	15MCA446	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of foundational methodologies, techniques and tools that understanding the successful implementation of enterprise resource planning (ERP) systems
2. Focusing on integrating business processes in an enterprise resource planning (ERP) system. Students will experience both, the end-user and configuration perspectives of an ERP system implementation

Pre-requisites:

1. Knowledge of Business Process Reengineering, Data Warehousing, Data Mining, On–line Analytical Processing, Supply Chain Management.
2. Business Modules in an ERP Package, Finance, Manufacturing, SAP software

Unit – I — 10 Hours

Introduction To ERP

Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering, Data Warehousing, Data Mining, On–line Analytical Processing, Supply Chain Management.

Unit – II — 12 Hours

ERP Implementation

Implementation Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation ,Vendors, Consultants and Users ,Contracts , Project Management and Monitoring

Unit – III — 10 Hours

Business Modules

Business Modules in an ERP Package, Finance, Manufacturing, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution.

Unit – IV — 10 Hours

ERP Market

ERP Market Place, SAP AG, PeopleSoft ,Baan Company , JD Edwards World Solutions Company, Oracle Corporation ,QAD

Self-learning topics: System Software Associates

Unit – V — 10 Hours

ERP – Present and Future

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

Self-learning topics: Future Directions in ERP.

Books

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, 1999
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
4. Jose Antonio Fernandz, “ The SAP R /3 Hand book”, Tata McGraw Hill

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Demonstrate** the basic structure of an Enterprise Resource Planning system	L 2
2.	**Demonstrate** typical integrated business processes in an ERP, such as procurement, production, and fulfillment	L 2
3.	**Design** common business transactions as an end-user in an ERP system	L 6
4.	**Perceive** as a member of an ERP implementation or configuration team	L 5
5.	**Analyze** and **evaluate** the critical stage of implementation in the development of enterprise wide systems	L 4, L 5
6.	**Build** an ERP system for specific business processes	L 6
7.	**Evaluate** and **discuss** the need for linking enterprise mission & goals with the implementation of ERP systems	L 5, L 6
8.	**Develop** and **demonstrate** the use of SAP tools to aid and understand the implementation process	L 2, 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 design a system, component or process as per needs and specifications	**4**
4.	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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Operations Research

Course Code	15MCA447	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the given problem and applies the fundamental techniques of operations research in solving the problem
2. Learning the necessary available techniques for Managerial decision making situations within business contexts
3. Introducing programming skills to design and implementing software solutions to solve problems in the domain of operations research

Pre-requisites:

1. A course on MIS (15MCA35)
2. Knowledge of Basic mathematics, MIS.
3. Knowledge of Probability and Statistics

Unit – I **12 Hours**

Introduction and Overview of the OR Modelling Approach, Introduction to Linear Programming:

The origin of OR, the nature of OR, the impact of OR, defining the problem and gathering data, formulating a mathematical model, deriving solutions from the model, testing the model, preparing to apply the model, implementation.

Formulation of linear programming problem (LPP), examples, Graphical solution, the LP Model, Special cases of Graphical method, assumptions of Linear Programming (LP), additional example

Unit – II **10 Hours**

Solving LPP - the Simplex Method:

The essence of the simplex method, setting up the simplex method, algebra of the simplex method, the simplex method in tabular form, special cases in the simplex method, tie breaking in the simplex method, adopting to other model forms (Two Phase method, Big-M method)

Self-learning topics: Revised Simplex Method, Post optimality analysis

Unit – III **10 Hours**

Duality Theory and Sensitivity Analysis:

The essence of duality theory, economic interpretation of duality, primal dual relationship, adapting to other primal forms, the role of duality in sensitive analysis, the dual simplex method

Self-learning topics:

Unit – IV **10 Hours**

Transportation and Assignment Problems

The transportation problem, a stream line simplex method for the transportation problem, the assignment problem, a special algorithm for the assignment problem

Self-learning topics:

Unit – V **10 Hours**

PERT and CPM, Game Theory:

Network representation, Critical path (CPM) computations and PERT networks.

The formulation of two persons, zero sum games, solving simple games- a prototype example, games

with mixed strategies, graphical solution procedure, solving by linear programming, extensions.
Self-learning topics: Scheduling a Project with PERT/CP

Books

1. Frederick S.Hillier& Gerald J.Lieberman: Introduction to Operations Research, 8thEdition, Tata McGraw Hill, 2006
2. Hamdy A Taha: Operations Research - An Introduction, 7th Edition, Pearson
3. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Thomson Course Technology, 2003

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Design** and **build** mathematical models to achieve higher profits and lower costs in business making decisions	L 6
2.	**Apply** the tools and techniques in making critical thinking and objective analysis of decision problems in project management	L 3
3.	**Analyze** the decision-making problem and identify the appropriate technique that can be applied to solve the problem	L 4
4.	**Evaluate** performance of system or decision taken	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 identify, formulate and solve engineering problems	**2**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
5.	Postgraduates will demonstrate research-based knowledge and research methods for addressing current issues in research trends	**12**

	Course delivery methods		**Assessment methods**
1.	**Lecture**	1.	**Internal Assessment Test**
2.	**Power-Point Presentation**	2.	**Quiz**
3.	**Video**	3.	**Assignment/Seminar/Project**
4.		4.	

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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Elective Group-2

Big Data Analytics

Course Code	**15MCA451**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of big data and need of NoSQL.
2. Understanding the contrast between Big Data platforms
3. Exploring web data evolution and interpreting regression modeling
4. Describing neural networks and principles of Fuzzy logic
5. Describing data model architecture and elaborating Hadoop concepts

Pre-requisites:

1. A course on Database management system (MCA22).
2. Knowledge RDBMS, NOSQL

Unit – I **10 Hours**

INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Traits of Big data -Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

Unit – II **12 Hours**

DATA ANALYSIS

Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.

Unit – III **10 Hours**

MINING DATA STREAMS

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real Time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis

Self-Learning Topics: Stock Market Predictions.

Unit – IV **10 Hours**

FREQUENT ITEMSETS AND CLUSTERING

Mining Frequent Itemsets - Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data – CLIQUE And PROCLUS – Frequent Pattern based Clustering Methods – Clustering in Non-

Euclidean Space – Clustering for Streams and Parallelism

Unit – V **10 Hours**

FRAMEWORKS AND VISUALIZATION

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association-Intelligence from unstructured information-Text analytics-Understanding of emerging trends and technologies

Self-Learning Topics: Industry challenges and application of Analytics

Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011
6. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Define** and **Rephrase** the limitations of RDBMs , need of NoSQL, Big Data and different NoSQL products available in market	L1, L 2
2.	**Apply** CRUD operations with MongoDB, storing data and accessing data with MongoDB/CouchDB/Cassandra	L 3
3.	**Construct** MapReduce –parallel programming model for distributed processing on large data sets on a cluster of computers	L6
4.	**Analyze** infrastructure on Hadoop and **Analyze** Big Data with Hive using Apache Pig	L 4
5.	**Develop** Web applications using NoSQL, Python and PHP	L 3
6.	**Construct** MapReduce –parallel programming model for distributed processing on large data sets on a cluster of computers	L 6
7.	**Create** Apache Hive –data warehouse infrastructure on Hadoop and **Analyze** Big Data with Hive using Apache Pig	L 6, L 4
8.	**Develop** Web applications using NoSQL, Python and PHP	L 3

	Program Outcome of 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 a system, component or process as per needs and specifications	**4**
4.	Postgraduates will demonstrate skills to use modern software tools and	**6**

	technology to build and test applications	
5.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
6.	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. Internal Assessment Test
2. Power-Point Presentation	2. Quiz
3. Video	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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Finite Automata and Formal Languages

Course Code	**15MCA452**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the theoretical foundations and basic principles of Computer Science like Automata, Formal languages and Computability and Complexity
2. Encouraging the students to gain the logic building capabilities for various mathematical arguments and scientific problems
3. Making the students to understand the concepts like Finite Automata and certain kinds of Formal languages which are used in the design and construction of Computer hardware/software
4. Making the students to understand and appreciate the properties of Regular languages and Context Free languages and proving certain languages are Non-regular and Non Context Free languages by the application Pumping lemma to perform various operations on Formal languages and take decision to solve varieties of problems that are of practical importance
5. Making the students aware of use of Context Free grammar in specifying programming languages and be able to understand the relation between Context Free grammar and a class of Automata called Push Down Automata which is found immediate application in programming language specification and building an efficient Compiler for some languages
6. Understanding important concepts like Turing Machine, Multiple Turing Machine and Non-Deterministic Turing machine, helps to conclude that the Turing machine is the ultimate among different models of computation

Pre-requisites:

1. Knowledge of programming constructs
2. Discrete Mathematics (MCA14)
3. Data Structures (MCA21)

Unit – I **10 Hours**

Introduction to Finite Automata:

Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata; An application of finite automata; Finite automata with Epsilon-transitions

Self-Learning Topics: Moore Mealy Machines

Unit – II **12 Hours**

Regular Expressions and Regular Languages:

Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.

Self-Learning Topics: Regular Grammar and implementation

Unit – III **10 Hours**

Context-Free Grammars and Languages:

Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages. Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

Self-Learning Topics: Context Sensitive Grammar

Unit – IV **10 Hours**

Pushdown Automata:

Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata

Unit – V **10 Hours**

Introduction to Turing Machine:

Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines.

Self-Learning Topics: Turing Machine to check for wrong spelling

Books

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2007
2. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3rd Edition, PHI Learning, 2009
3. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998
4. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007
5. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Identify** and **explain** concept and importance of Automata Theory. Analyze the problem and identify the use of Deterministic Finite Automata and Nondeterministic Automata	L2, L3
2. **Identify** the applications of Finite Automata and Regular expression, achieve proficiency in the design of Finite Automata with Epsilon transitions and **apply** software tools based on Formal languages and models of computation	L2, L3
3. **Identify** and **explain** the problems that computers cannot solve. **Explain** the working principle of Turing Machine. Achieve the proficiency in the programming techniques of Turing machines. **Identify** the extensions to the basic Turing Machines, Turing Machines and Computer	L2, L3
4. **Design**, and **prove** certain languages are not Regular languages by applying Pumping lemma, Closure properties of Regular languages and decision properties of regular languages. Simplify the equivalence and minimization of Automata	L4, L5, L6
5. **Identify** and **simplify** certain Context Free Grammars and languages to be	L3, L4

	ambiguous also the application of Context Free Grammars	
6.	**Discuss** the limitation of Regular languages and the working principle of Push Down Automata (PDA) and achieve proficiency in the design of PDA for Context Free Languages (CFL). **Explain** the language of a PDA and **simplify** the equivalence of PDA's, CFG's and Deterministic Push Down Automata	L2, L4, L6
7.	**Discuss** and **prove** certain languages not to be Context Free Languages by applying Pumping lemma and Closure properties of context free languages. **Distinguish** the different Normal forms of Context free languages with illustrative examples	L4, L5, 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 demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
5	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
6	Postgraduates can participate and succeed in competitive examinations	**11**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Software Architecture

Course Code	15MCA453	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the challenges of advanced software design and the issues associated with large-scale software architectures, frameworks, patterns and components
2. Exploring the tools and techniques used for the automatic analysis and evaluation of software

Pre-requisites:

1. Analysis of Algorithms (MCA41)
2. Software Engineering (MCA33)

Unit – I — 10 Hours

Introduction to Software Architecture and its context:
Meaning of software architecture and its scope; Architectural Structures and views; Architectural patterns; Features of a good Architecture. Importance of Software Technical Context; Project life-cycle context; Business context; Professional context; Stake holders; Influence of Software Architecture

Unit – II — 10 Hours

Understanding Quality Attributes Architecture & Requirements:
Functionality; quality attribute considerations; Specifying and achieving Quality attribute requirements; Guiding quality design decisions; Availability; Interoperability; Modifiability; Performance; Security; Testability; Usability

Unit – III — 11 Hours

Quality Attribute modeling and Analysis:
Modeling Architecture to enable quality attribute analysis; Quality attribute check lists; Through experiments and Back-of-the envelope analysis; Experiments; Simulations and prototypes; Analysis at different stages of the life cycle

Unit – IV — 10 Hours

Architecture and requirements:
Gathering ASRs from requirements documents; ASRs by interviewing stake holders; ASRs by understanding the business; capturing ASRs in a utility tree; Typing the methods together

Unit – V — 11 Hours

Designing an Architecture:
Design strategy; the attribute driven design methods; the steps of ADD Documenting Software Architecture: Uses and Audiences for architecture documentation; Notations, View and Behavior

Self-Learning Topics: Documentation and quality attributes

Books

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3d Edition, Pearson Education
2. Richard N. Taylor, Nenad Medvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley- India 2012

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**List** the major approaches to automated software analysis achievable through static and dynamic analysis	L 1
2.	**Classify** some of the challenging design issues that software engineers face and the trade-offs associated with the solutions to these	L 2
3.	**Explain** the principles behind software patterns and be able to apply a number of the fundamental patterns	L 2
4.	**Demonstrate** practical competence in the application and construction of tools to support automated software analysis	L 2
5.	**Compose** the need for software architecture and the principles of the classic architectural styles	L 6

	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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Mobile Applications

Course Code	**15MCA454**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing the basic knowledge of Mobile applications
2. Understanding mobile application users, information design, mobile platforms and using the tools for interface design.
3. Emphasizing on the basics of Android, guide them in Android application development, designing user interfaces using views, pictures and menus
4. Introducing data persistence, creating and using databases
5. Introducing the IOS tools, debugging IOS apps, working with Objective C. Introducing the Windows Phone 7 tools and building a simple application in windows app

Pre-requisites:

1. Basic knowledge of computer and logic building capabilities.
2. Knowledge of IDE.

Unit – I — 12 Hours

Introduction to Mobile Applications

Cost of Development, Mobile Applications, Marketing, Introduction to web services, web service language formats, Understanding Mobile Application Users – Understanding Mobile Information Design – Understanding Mobile Platforms

Self-learning topics: Developing WCF Application in Visual Studio

Unit – II — 10 Hours

Mobile User interface Design and Mobile Websites

Choosing a Mobile Web Option, Adaptive Mobile Website, Mobile Web Applications with HTML 5

Unit – III — 10 Hours

Introduction to Android

Android – Deciding to target android as your mobile platform, Getting the tools you need, Understanding Activities, Linking activities, Calling Build-in-Applications using Intents, Displaying Notifications, Understanding the components of a screen

Unit – IV — 10 Hours

Designing Android user-interfaces and Data Persistence

Designing the user interface using views **–** Basic views, Picker views, List views, using image views to display pictures, using menus with views. Data Persistence – saving and loading user preferences, Persisting Data to Files, Creating and using Databases

Unit – V — 10 Hours

Android Messaging, Networking, Location Based Services

SMS Messaging, Sending E-mail – Networking – Downloading Binary Data, Text Files- Accessing Web Services – Performing Asynchronous Calls – Location Based Services – Displaying Maps – Getting Location Data – Creating your own services – Communicating between a service and an activity – Binding activities to Services

Self-learning topics: IOS and Windows Phone 7

Books

1. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox 2012.
2. Wei – Meng Lee, Beginning Android Application Development, Wiley 2011
3. Reto Meier: Professional Android 4 Application Development, Wrox Publications 2012

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **List** the importance of Mobile Strategies in Business World	L 1
2. **Identify** the tools required for Mobile interface Design	L 3
3. **Apply** HTML 5 in Mobile Web Applications development	L 3
4. **Design** interfaces using views, displaying pictures and menus.	L 6
5. **Develop** apps with Data Persistence	L 6
6. **Develop** simple apps in Android, IOS and Windows Phone7	L 6

	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 an ability to design a system, component or process as per needs and specifications	**4**
4.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities	**7**
7.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
8.	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. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Video**	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	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Client-Server Computing

Course Code	15MCA455	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of core aspects of Software Architecture and the need for software architecture
2. Exploring the concepts of middleware architecture design principles, requirements traceability and to insure the system meets crosscutting end-to-end software architectural properties
3. Implementing an architectural specification and to construct architectures in a teamwork setting with minimal requirements
4. Applying software-sizing analysis based on architectural components and requirements analysis

Pre-requisites:
A course on computer network (15MCA31)

Unit – I — 12 Hours

Introduction to Client/Server Computing:
Advantages of Client/Server computing, Architecture – Data access Architecture, Execution Architecture, Vertical Slice – two-tiered Client /Server, Stored procedure, Three tired Architecture
Self-learning topics:MVC Model

Unit – II — 10 Hours

Client services:
Role of the client, Client services, Remote Procedure call, print services, remote services, Utility Services, Message services, Network Services, Application Services, Database Services, Dynamic Data Exchange(DDE),Object Linking and embedding, Common Object request broker architecture, client tools, Non GUI, GUI Object user interface clients(OOUI).

Unit – III — 10 Hours

Server functionality:
Request processing File Services, Database service, Communication Services, Security Services, Network Operation System, Platforms, Server Operating Systems.

Unit – IV — 10 Hours

Connectivity:
Open systems interconnect, Communications, Interface technology, Inter-process communications, wide area network technology, Network Management. Application development environment definition, productivity measures, performance, support, organization and management, task allocation server and client side

Unit – V — 10 Hours

Distributed objects and components:
CORBA compound documents, Opendoc component model, OLE/DCOM

Books

1. Client/Server computing by Patrick Smith and Steve Guengerich 2nd Edition, Prentice Hall, 2011
2. The Essential Client/Server survival Guide' by Robert Orfali, Dan Harkey, Jeri Edwards, 2nd edition, Galgotia Publications, 1999
3. Client Server System Design and implementation by Larry T Vaughn, McGraw-Hill international Edition, 1994
4. The CORBA Reference Guide by Alan Pope Addison Wesley, 1997

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Illustrate** the significance of middleware architecture design principles	L 2
2. **Identify** and compose design patterns	L 3
3. **Analyze** the requirements traceability and to insure the system meets cross-cutting end-to-end software architectural properties	L 4
4. **Compar**e architectural styles including distributed computing, service-oriented architectures, database-centric architectures, web architectures, email and AI architectures	L 2
5. **Build** existing systems and then extend them with new capabilities using concepts from architecture description languages	L 6

	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 demonstrate an ability to analyze and build computer applications for multiple domains	**5**
4.	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. **Internal Assessment Test**
2. **Power-Point Presentation**	2. **Quiz**
3. **Video**	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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Principles of User Interface Design

Course Code	15MCA456	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of usability, design principles, guidelines, heuristics and other fundamentals of Human-Computer Interaction
2. Analyzing a set of requirements in terms of its user-interface implications
3. Developing a usage scenario for a given set of user requirements and available technologies. Construct a user-interaction strategy for a given problem
4. Sketching a series of user-interfaces for a given use scenario
5. Implementing a designed user-interface to demonstrate its functionality and usability
6. Employing a set of usability engineering methods to refine a designed user-interface
7. Evaluating a user-interface using suitable evaluation methodology.

Pre-requisites:
A course on software engineering (15MCA33).

Unit – I 10 Hours

Introduction:
Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession. Guideline, principles, and theories**:** Introduction, Guidelines, principles, Theories, Development Processes Managing Design Processes: Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies: Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Legal Issues.
Self-learning topics : Comparative study of the different types of interface designs

Unit – II 10 Hours

Evaluating Interface Design:
Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments Interaction Styles Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of direct manipulation, 3D Interfaces, Tele-operation, Virtual and Augmented Reality Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry With Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays

Unit – III 12 Hours

Command and Natural Languages:
Introduction, Command-organization functionality strategies and structure, Naming and Abbreviations, Natural Language in computing.
Interaction Devices**:** Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory interfaces, Displays-Small and Large

Unit – IV **10 Hours**

Design Issues:

Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response time, Frustrating Experiences Balancing Function and Fashion:Introduction, Error Messages, Non-anthropomorphic Design, Display design, web page design, Window Design, Color User Documentation and Online Help : Introduction, Online versus paper documentation, Reading from paper versus Displays, Shaping the content of the Manuals, Accessing the Documentation, Online Tutorials and animated demonstrations, Online Communities for User Assistance, The Development Process.

Self-learning topics: Comparative study of mobile interfaces and desktop interfaces

Unit – V **10 Hours**

Information Search and Visualization:

Introduction, Search in Textual Documents and Database Querying, Multimedia document search, Advanced filtering and Search Interfaces, Information Visualization: Introduction, Data type by task taxonomy, Challenges for information visualization

Self-learning topics: Exploring the essentials aspect of designing and development of user interface

Books

1. Ben Shneiderman, Plaisant, Cohen, Jacobs: Designing the User Interface, 5th Edition, Pearson, Education, 2010
2. Alan Dix, Janet Finalay, Gregory D AbiwdmRusselBealel: Human-Computer Interaction, 3rdEdition, Pearson, Education, 2008
3. Eberts: User Interface Design, Prentice Hall, 1994

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Plan and Develop** a methodology for effective design of user-interface to relevant stakeholders using design rationale and a sketching/presentation tool in an informed, reasonable and persuasive way	L 6
2.	**Apply** design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem	L 3
3.	**Interpret** and **determine** the Benefits of Structure, Naming and Abbreviations, Command Menus, Natural Language in Computing	L 2, L 5
4.	**Identify** and usage the Interaction Devices, Keyboards and Function Keys, Pointing Devices, Speech Recognition, Digitization, and Generation, Image and Video Displays, Printers	L 3
5.	**Design** a usable and compelling user-interface given a set of requirements and available technologies	L 6
6.	**Evaluation** of user-interface in consultation with stake holders for employing a series of evaluation methods available in usability engineering	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 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**
4.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
5.	Postgraduates will demonstrate knowledge of professional and ethical	**7**

	responsibilities.	
6.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Mobile Computing

Course Code	**15MCA457**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Inculcating knowledge of Mobile Computing, Mobile Computing Architecture, and Mobile Computing Environment
2. Describing the various technologies like Global System for Mobile Communication (GSM), Short Message Service (SMS), General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA), Third Generation for Mobile Telecommunication (3G), and World Wide Interoperability for Microwave Access (WiMAX).
3. Understanding Mobile Handsets with their design and Mobile Operating System with their features
4. Elaborating Mobile Internet Applications with respect to Thin Client, Wireless Application Protocol (WAP) and various Markup Languages.

Pre-requisites:

1. In-depth knowledge of Computer Networks (MCA31) and Internet.
3. Awareness of latest trends in Mobile Operating System and Wireless Communication

Unit – I **10 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 **10 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 **08 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 **10 Hours**

Code Division Multiple Access (CDMA), Third Generation for Mobile Telecommunication (3G), World Wide Interoperability for Microwave Access (WiMAX), and Mobile Client:

Spread-Spectrum Technology: Direct Sequence Spread Spectrum (DSSS), Interim Standard 95 (IS-95): Speech and Channel Coding, IS-95 Architecture, IS-95 Channel Structure, IS-95 Call Processing, Authentication and Security, Handoff and Roaming, IS-95 Channel Capacity. CDMA versus GSM. Wireless Data. Third Generation Networks: International Mobile Telecommunications – 2000, CDMA-2000, Universal Mobile Telecommunications System/Wideband Code Division Multiple Access (UTMS/WCDMA), Fixed Wireless. General and Specific Applications of 3G.

Moving Beyond The Desktop, A Peek Under The Hood, Mobile Phones, Features of Mobile Phones, Personal Digital Assistant (PDA), and Design Constraints in Application for Handheld Devices.

Self-Learning Topics: Introduction to Mobile IP and Mobile IP with IPV6

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Unit – V **12 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).

Self-Learning Topics: Midlet Programming

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, Mobile Computing Architecture, and describe design considerations for Mobile Computing	L2
2.	**Explain** Mobile Phones, Mobile OS and their features	L2
3.	**Illustrate** Global Systems for Mobile Communications (GSM) and Short Service Messages (SMS), GPRS, Packet Data Network, 3G and WiMAX	L2
4.	**Construct** the complete phases of software development life cycle of any mobile application	L6
5.	**Design** and **develop** Mobile Internet Applications using the state of the art technologies and various Markup Languages	L6

Program Outcome of this course (POs)		**PO No.**
1.	Post graduates 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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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**
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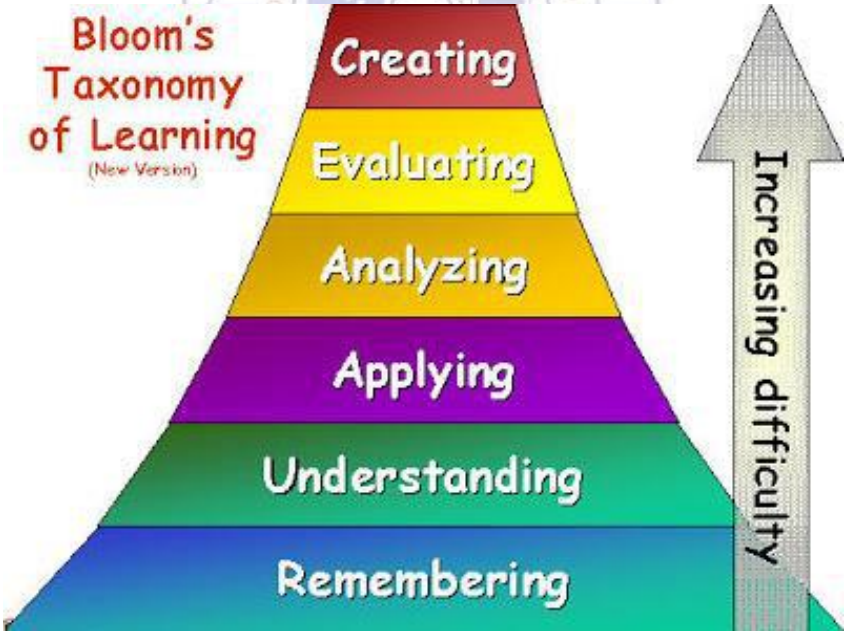
Bloom's Taxonomy of Learning Objectives

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.



KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

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

Scheme and Syllabus (2015 Scheme)

5th Semester Master of Computer Applications (M.C.A.)

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.

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 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 SPECIFIC OUTCOMES (PSOs):

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.

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.

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.

Scheme of Teaching

V Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours	CIE Marks	SEE Marks	Total Marks
1	15MCA51	Object Oriented Modeling and Design	CC	4-0-0	4	4	50	50	100
2	15MCA52	Topics in Enterprise Architecture-2 (C#.NET)	CC	4-0-0	4	4	50	50	100
3	15MCA53	Simulation and Modeling	CC	4-0-0	4	4	50	50	100
4	15MCA54X	Elective – 3	GE	4-0-0	4	4	50	50	100
5	15MCA55X	Elective – 4	GE	4-0-0	4	4	50	50	100
6	15MCA56	Object Oriented Modeling and Design laboratory	CC	0-0-1	2	3	50	50	100
7	15MCA57	Topics in Enterprise Architecture-2(C#.NET) Laboratory	CC	0-0-1	2	3	50	50	100
8	15MCA58	Project Work-1	CC	0-0-1	2	3	50	50	100
			Total	**20-0-3**	**26**	**29**	**400**	**400**	**800**

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

Elective Groups

Note: Students are advised to select any one subject from the following elective groups for Elective-3 and Elective-4 respectively.

Elective Group- 3

Sl. No.	Course Code	Course Title
1	541	Data Mining and Data Warehousing
2	542	Compiler Design
3	543	Services Oriented Architecture
4	544	Digital Marketing
5	545	Software Project Management
6	546	Supply Chain Management
7	547	Digital Image Processing

Elective Group- 4

Sl. No.	Course Code	Course Title
1	551	NOSQL
2	552	Web 2.0 and Rich Internet Applications
3	553	Storage Area Networks
4	554	Information and Network Security
5	555	Mobile Ad-hoc Sensor Network
6	556	Professional Communications and Ethics
7	557	Pattern Recognition

Object Oriented Modeling and Design Patterns (Theory)

Course Code	15MCA51	Credits	04
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 Marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. 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. Comprehend enough Java to see how to create software the implements the OO designs modeled using UML
3. 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

Pre-requisites :

A course on Object Oriented Programming-II (java)- MCA32

Unit – I 11 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; OO modeling history. 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

Self-learning Topics: Metadata; Reification; Constraints; Derived data; Packages

Unit – II 10 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

Self-learning Topics: Relation of class and state models, Use case relationships; Procedural sequence models; Special constructs for activity models

Unit – III 10 Hours

Process Overview, System Conception, Domain Analysis and Application Analysis:

Process Overview: Development stages; Development life cycle. System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. Application Analysis: Application interaction model; Application class model

Self-learning Topics: Application state model; adding operations

Unit – IV **11 Hours**

System Design and Class Design:

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example. Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design;

Self-learning Topics: Reification of behavior; Adjustment of inheritance; Organizing a class design

Unit – V **10 Hours**

Design Patterns:

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. Introduction, structural decomposition, Organization of work, Model View Controller; Communication Patterns: Client-Dispatcher-Server; Publisher-Subscriber; Management Patterns: Command processor; Whole Part, View Handler

Self-learning Topics: Forwarder-Receiver, Master Slave

Books

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML 2nd Edition, Pearson Education / PHI, 2005
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2006
3. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John M. Vlissides
4. Head First Design Patterns, Elisabeth Freeman, Eric Freeman, Bert Bates, Kathy Sierra

Course Outcome (COs)

	At the end of the course, the student will be able to	Bloom's Level
1.	**Apply** knowledge of software engineering methods, such as object-oriented analysis and design methods with a clear emphasis on UML.	L2
2.	**Analyze and design** software systems, components to meet desired needs	L4
3.	**Identify, formulate and solve** software development problems: software requirements, specification (problem space), software design, and implementation (solution space).	L3
4	**Apply** the graphical UML representation using tools, such as IBM's Rational Software Architect and Net Beans	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**
3.	Postgraduates will demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
4	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6	Postgraduates can participate and succeed in competitive examinations	**11**

	Course delivery methods		Assessment methods
1.	**Lecture**	1.	**Internal Assessment Test**
2.	**Power-Point Presentation**	2.	**Quiz**
3.	**Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Topics in Enterprise Architecture-2 (C#.NET) (Theory)

Course Code	15MCA52	Credits	04
Course type	CC	CIE Marks	50 Marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 Marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Imparting the knowledge of the core aspects of the .NET platform
2. Exploring in detail the characteristics of the C# programming language, including new syntactical constructs introduced with .NET 2.0
3. Exploring the object-oriented features of C# programming language such as encapsulation, inheritance, and polymorphism
4. Focusing on ADO.NET technology as a way to interact with database
5. Providing an insight into the fundamentals of ASP.NET and their usage to give sufficient knowledge to build rich client applications for desktop, laptop, and tablet PCs

Pre-requisites: Object Oriented Programming using C++ and Java (MCA24/MCA32).

Unit – I 10 Hours

Getting started with .NET Framework 4.0 and C# introduction:
Benefits of .NET Framework, Architecture of .NET Framework 4.0, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms, ASP .NET and ASP .NET AJAX, ADO .NET ,LINQ.
Need of C#, C# Pre-processor Directives, Creating a Simple C# Console Application, Identifiers and Keywords. Data Types, Variables and Constants: Value Types, Reference Types, Type Conversions, Boxing and Undoing, Variables and Constants. Expression and Operators : Operator Precedence, Using the ?? (Null Coalescing) Operator, Using the :: (Scope Resolution) Operator and Using the is and as Operators. Control Flow statements: Selection Statements, Iteration Statements and Jump Statements.

Unit – II 12 Hours

Namespaces, Classes, Objects, Structures and Object- Oriented Programming:
Namespaces, The System namespace, Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and Static Class Members. Properties: Read-only Property, Static Property, Accessibility of accessors and Anonymous types. Indexers, Structs: Syntax of a struct and Access Modifiers for structs.
Encapsulation: Encapsulation using accessors and mutators, Encapsulation using Properties. Inheritance: Inheritance and Constructors , Sealed Classes and Sealed Methods , Extension methods. Polymorphism: Compile time Polymorphism/ Overloading, Runtime Polymorphism/ Overriding. Abstraction: Abstract classes, Abstract methods. Interfaces: Syntax of Interfaces.
Self-Study Topics: Implementation of Interfaces and Inheritance

Unit – III 08 Hours

Delegates and Events, Exception Handling :
Delegates, Creating and using Delegates, Muticasting with Delegates.
Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers. Exception Handling: The try/catch/finally statement, Checked and Unchecked Statements.

Self-Study Topics: Custom Exceptions, Checked and Uncheked

Unit – IV **10 Hours**

Data Access with ADO.NET:

Understanding ADO.NET: Describing the Architecture of ADO.NET, ADO.NET Entity Framework. Creating Connection Strings: Syntax for Connection Strings. Creating a Connection to a Database: SQL Server Database, OLEDB Database, ODBC Data Source, Creating a Command Object. Working with DataAdapters: Creating DataSet from DataAdapter, Paging with DataAdapters, Updating with DataAdapters, Adding Multiple Tables to a DataSet, Creating Data View. Using DataReader to Work with Databases.

Unit – V **10 Hours**

Web App Development with ASP.NET:

Introduction, Web Basics, Multitier Application Architecture, Your First Web Application: Building Web Time Application, Examining Web Time.aspx's Code-Behind File, Standard Web Controls: Designing a Form, Validation Controls, Session Tracking, Cookies, Session Tracking with http Session State, Options.aspx :Selecting a Programming Language, ecommenations.aspx: Displaying Recommendations based on Session Values

Self-learning Topics: Graphical User Interface with Windows Forms

Books

1. NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiely-Dream Tech Press
2. Paul Deitel and Harvey Deitel: C# 2010 for Programmers, 4th Edition, Pearson Education.
3. Andrew Trolsen: Pro C# 5.0 and the .NET 4.5 Framework, 6th Edition, Wiely-Appress.
4. Bart De Smet: C# 4.0 Unleashed, Pearson Education- SAMS Series
5. Hebert Shildt: Programming in C# 4.0, Tata McGraw Hill.

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Define** and **illustrate** the components of .NET framework	L2
2.	**Explain** the basic concepts of C# programming language, .NET framework and provide examples of real world problems	L2
3.	**Investigate** various concepts of C# programming language, such as encapsulation, operator overloading, indexers along with their internal representations	L4
4.	**Implement** various concepts of C# programming language such as delegates, events, and exception handling and demonstrate them	L3
5.	**Build** GUI application using Winforms as front end and ADO.NET technology as backend	L5
6.	**Develop** rich and dynamic website and web applications using ASP.NET technology	L5

	Program Outcome (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**
4	Postgraduates will demonstrate skills to use modern software tools and	**6**

technology to build and test applications

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):

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Scheme of Semester End Examination (SEE):

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*****

Simulation and Modeling (Theory)

Course Code	**15MCA53**	**Credits**	04
Course type	CC	**CIE Marks**	50 Marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 Marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understanding the concepts of system, models in general and simulation models in particular
2. Developing simulation models using general purpose programming language Java, and simulation programming language –GPSS
3. Exploring the various techniques to generate random numbers and test for randomness
4. Developing an input model for a given system
5. Verify, Validate and perform output analysis of a simulation model.

Pre-requisites:

1) Degree level Mathematics and Statistics.
2) Software Engineering (MCA33).

Unit – I 12 Hours

Introduction to Simulation: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation, Areas of application, Systems and system environment, Components of a system, Discrete and continuous systems, Model of a system, Types of Models, Discrete-Event System Simulation, Steps in a Simulation Study; Simulation examples: Simulation of queuing systems, Simulation of inventory systems

Self-learning Topics: Phases of Software engineering and queueing system

Unit – II 10 Hours

Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing, Simulation in Java, Simulation in GPSS; Statistical Models in Simulation: Review of terminology and concepts, Discrete distributions, Continuous Distributions-Uniform distribution, Exponential distribution, Normal distribution.

Self-learning Topics: Java programming and Differentiation and Integration in calculus.

Unit – III 10 Hours

Random-Number Generation: Properties of random numbers, Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers. Random-Variate Generation: Inverse transform technique-Exponential Distribution, Uniform Distribution, Discrete Distributions, Acceptance-Rejection technique: Poisson Distribution, Convolution method.

Self-learning Topics: Basic knowledge of Probability

Unit – IV 10 Hours

Queueing Models and Input Modeling: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems; Input Modeling: Data

Collection, Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Selecting input models without data.

Self-learning Topics: Definition of model and queuing.

Unit – V **10 Hours**

Verification and Validation of Simulation Models: Model building, verification and validation, Verification of simulation models, Calibration and validation of models, Output Analysis for a Single Model: Types of simulations with respect to output analysis, Stochastic nature of output data; Measures of performance and their estimation.

Self-learning Topics: Knowledge verification and validation in Software Engineering.

Books

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson, 2010.
2. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson / Prentice-Hall, 2006.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify** the concepts of simulation used to develop models.	L3
2. **Design** and **develop** models using simulation algorithm techniques.	L6
3. **Design** and **develop** techniques to generate and test random numbers.	L6
4. **Design** and **develop** an input model for a given simulation system.	L6
5. **Solution** of Verification, Validation and Perform output analysis of a simulation model.	L 6

Program Outcome of this course (POs)	PO No.
1. Post graduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
2. Post graduates 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**
4. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5. 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. **Videos**	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	**30**	**10**	**10**	**50**

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Software Design Laboratory (Lab)

Course Code	**15MCA56**	**Credits**	02
Course type	CC	**CIE Marks**	50 Marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 Marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Exploring object oriented design problems through the application of design patterns.
2. Developing high level class diagram, sequence diagram, use case diagram, activity diagram in UML for each pattern
3. Emphasizing the consequences of applying each pattern to the overall software quality of a system

Pre-requisites: JAVA Programming Language (MCA32).

Laboratory Exercises

Maximum 10 programs can be framed on the following concepts/strategies:
UML Diagrams:
Class diagrams, Use Case diagrams, sequence diagrams, activity diagrams
Design patterns:

Books

1. Pattern-Oriented Software Architecture Volume 1: A System of Patterns: Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal.
2. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John M. Vlissides
3. Head First Design Patterns, Elisabeth Freeman, Eric Freeman, Bert Bates, Kathy Sierra

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Demonstrate** a thorough understanding of patterns and their underlying principles.	L2
2.	**Apply** design patterns to any given problem.	L5
3.	**Use** design patterns when developing software.	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 an ability to analyze and build computer applications for multiple domains.	**5**
4.	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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration**.**		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Topics in Enterprise Architecture-2 Laboratory (C#.NET) (Lab)

Course Code	15MCA57	**Credits**	02
Course type	CC	**CIE Marks**	50 Marks
Hours/week: L-T-P	0-0-1	**SEE Marks**	50 Marks
Total Hours:	42	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Providing a clear understanding of .Net technology using C# and implement object oriented techniques like encapsulation, polymorphism and inheritance using C# language
2. Imparting the knowledge to develop an application package with a database connection as a backend using the various programming constructs of C# along with the concepts of classes, objects, interfaces, structures, enumerations and delegates
3. Guiding to develop Windows Form application with database connectivity using ADO.NET technology
4. Guiding to develop Web application using ASP.NET for front-end and ADO.NET technology as back-end

Pre-requisites: Object Oriented Programming using C++ and Java (MCA24/MCA32).

Laboratory Exercises

Laboratory Exercises:
The following experiments shall be conducted using Visual Studio 2008 or Visual Studio 2012.

PART A

Implement 7 programs on the following concepts:

- Overloading using Indexer
- Encapsulation using properties in C#
- Jagged Array
- Delegates
- Event Handling in C#
- Abstract Class and Abstract methods in C#
- Run Time Polymorphism in C#.

PART B

Implement 2 Windows applications with SQL Server as backend using the following GUI components:
MDI Forms, Menu Bar, Labels, TextBoxes, Buttons, Group Boxes, ListBox, RadioButtons, CheckedBox, ComboBox, Date Time Picker etc.
Implement 1 Web application with SQL Server as backend using the following: Master Page, Content Pages, Hyperlinks to connect to content pages, Use GUI components like Labels, TextBoxes, Buttons, Group Boxes, ListBox, RadioButtons, CheckedBox, ComboBox etc.

Coding Practice

1. Use of Good Programming practices: Use of standard naming conventions, declaration of variables, indentation, documentation, simplicity of logic, efficiency of logic, uniformity in GUI design, Efficient usage of IDE and its automatic features.
2. Generic and Reusable code.

3. Inclusions of exceptional cases. Better usability

Books

1. .NET 4.0 Programming, BlackBook, Kogent Learning Solutions Inc. Wiley-Dream Tech Press
2. Paul Deitel and Harvey Deitel: C# 2010 for Programmers, 4th Edition, Pearson Education
3. Andrew Troelsen, Pro C# with .NET 3.0, Special Edition, Dream tech Press, India, 2007
4. Herbert Schildt, C#: The Complete Reference, Tata McGraw Hill, 2004

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Illustrate** object oriented programming like encapsulation, polymorphism and inheritance.	L2
2. **Elaborate** concepts like classes, objects, interfaces and delegates, jagged arrays, indexers, and event handling mechanism.	L6
3. **Develop** Windows Form application package with database connection using ADO.NET technology.	L6
4. **Develop** ASP application package with database connection using ADO.NET technology.	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 design and conduct experiments, analyze and interpret data.	**3**
5. 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	Journal submission	Lab test	Attendance	Total Marks
Maximum Marks: 50	20	10	10	10	50
➢	➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 25**				

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**
3. Initial write up 20 marks
   Conduct of experiments 20 marks — 50 marks
   Viva- voce 10 marks
4. **NOTE: Change of program during lab examinations is not permitted**

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Project work-1 (Lab)

Course Code	15MCA58	Credits	02
Course type	CC	CIE Marks	50 marks
Hours/week: L-T-P	0-0-1	SEE Marks	50 marks
Total Hours:	42	SEE Duration	3 Hours for 50 marks

Pre-requisites: Software Development tools & technologies, Programming languages.

Guidelines

1. A team of only two students must develop the mini project. However during the examination, each student must demonstrate the project individually.

2. The team may implement project of their choice using any one of the technologies learnt during 1st to 5th Semester.

3. The team must submit a brief project report (25-30 pages) that must include the following:
   a. Introduction
   b. Literature survey
   c. Hardware & Software Requirements
   d. Software Requirements specification
   e. Detailed design
   f. Implementation (source code and screenshots to be included)
   g. Testing
   h. Conclusion
   i. Future enhancements.
   j. Bibliography

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** effective user interfaces for the software application	L6
2. **Develop** applications using various tools and technologies, frameworks	L3
3. **Build** enterprise applications using database and server-side technologies	L6
4. **Test** and **deploy** competent mobile/console/web development solutions	L6
5. **Apply** UML techniques to build applications	L3

	Program Outcomes (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**
4.	Postgraduates will demonstrate skills to use modern software tools and	**6**

	technology to build and test applications.	
5.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**PO7**
6.	Postgraduates will be able to communicate effectively in both verbal and written form.	**PO8**
7.	Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional.	**PO9**
8.	Postgraduates will develop confidence for self-education and ability for life-long learning.	**PO10**

Scheme of Continuous Internal Evaluation (CIE):

Components	Phase-I	Phase-II	Phase-III	Report	Total Marks
Maximum Marks 50	10	15	15	10	50
➢	➢ Submission and certification of project report is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE: 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration.		
2.	**Viva-voce shall be conducted for individual student and not in a group.**		
3.	**Minimum marks required in SEE to pass: 20**		
4.	Initial write up	20 marks	50 marks
	Conduct of experiments	20 marks	
	Viva- voce	10 marks	
5.	**NOTE: Change of program during lab examinations is not permitted**		

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Elective Group-3

Data Mining and Data Warehousing

Course Code	**15MCA541**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Introducing Data Mining, Data Warehousing and its applications in real world
2. Understanding OLAP (Online Analytical Processing) and Knowledge Discovery form Data (KDD)
3. Extracting of patterns representing knowledge stored in large databases using KDD
4. Applying data processing techniques, visualization, predictive modeling, association analysis, and clustering etc
5. Constructing decision tree -classification, association analysis-frequent item set and clustering
6. Applying Data Mining methods to handle object, spatial, multimedia, text and web data
7. Extracting hidden information, patterns from large data repository
8. Interpreting multidisciplinary projects contributing to various topics such as statistics, visualization, artificial intelligence and machine learning

Pre-requisites:
A course on Database management system (MCA22).

Unit – I 12 Hours

Data Warehousing and OLAP:
Introduction, Operational Data Store(ODS), Extraction Transformation and Loading(ETL),Data Warehouse basic concepts, design issues, Guidelines ,metadata ,Data Warehouse Modeling, Data Cube and OLAP, Introduction, Data cube implementations and operations, OLAP Software's.

Unit – II 10 Hours

Data Mining:
Introduction, Motivating Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of similarity and dissimilarity, Data Mining Applications

Unit – III 10 Hours

Association Analysis: Basic Concepts and Algorithms:
Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative methods for generating Frequent Item sets, FP Growth Algorithm, Evaluation of Association Patterns.

Unit – IV 10 Hours

Classification Technique:
Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers. Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of clarification methods, Evaluation

criteria for classification methods, Multiclass Problem.
Self-Learning Topics: Artificial neural network(ANN)

Unit – V **10 Hours**

Clustering Techniques
Overview, features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis
Self-Learning Topics: Outlier Analysis**,** Web mining

Books

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison- Wesley, 2005
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009
3. Arun K Pujari: Data Mining Techniques University Press, 2nd Edition, 2009.
4. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006
5. Alex Berson and Stephen J. Smith: Data Ware housing, Data Mining, and OLAP Computing Mc GrawHill Publisher, 1997

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Define** Data warehousing process and the ETL process. **Design** issues of Data Warehousing	L 1, L6
2. **Explain** characteristics of OLTP and OLAP. Define and explain the Data cube operations in detail	L2, L1
3. **Define** Data Mining process and Knowledge Discovery Process (KDD). **Explain** about data measurement and collection issues	L1, L2
4. **Explain** issues in data processing proximity calculation. **Assess** selection of proximity measure for given application problem	L2, L5
5. **Illustrate** the concept of Association Rules, importance of support and confidence terms in mining association rules for a given sample data set. **Asses** about alternate approaches for generation of frequent item sets.	L2, L5
6. **Create** clusters on a given data set using clustering techniques.	L3
7. **Analyze** and construct decision tree for a given snap shot of problem. **Evaluate** the performance of specific classification model	L4, L3, L5
8. **Discuss** classification and classification models for input data set.	L6
9. **Demonstrate** FP-Growth algorithm for discovering frequent item sets. **Construct** FP-tree for given set of transactions	L2, L6

Program Outcome (POs)	PO No.
1. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains.	5
2. Postgraduates will demonstrate research based knowledge and research methods for addressing current issues in research trends.	12

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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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COMPILER DESIGN

Course Code	**15MCA452**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of different forms of language translators, overview of the structure of typical Compiler and the trends in programming languages and machine architecture that are shaping Compilers
2. Encouraging the students to gain the in-depth knowledge of the different phases of compilation process and implementation approach of each of the phases
3. Making the students aware of use of modern software development environments containing tools such as language editors, debuggers version managers and so on
4. Getting acquainted with more specialized tools to help implementation of various phases of Compiler such as Parser generators, Scanner generators, syntax directed translation engines,
   Code generator tools, Data flow analysis engines and compiler construction toolkits
5. Making students to understand and appreciate the capability of designing any new language interface based on real time industry requirements

Pre-requisites:

1. Knowledge of Formal Languages and Automata Theory,
2. A course on Data structures (15MCA21) and System software (15MCA25)

Unit – I **11 Hours**

Introduction: Lexical and Syntax Analysis:

Language processors, the structure of a Compilers, the evolution of programming languages, the science of building a compiler, Applications of Compiler technology, Programming language basics. Lexical analysis: The Role of Lexical Analyzer, Input Buffering, Specifications of Tokens, Recognition of Tokens. Syntax Analysis: Context-free Grammars, writing a Grammar, Top-down Parsing **Self-learning topics:** Operator Precedence Parser

Unit – II **11 Hours**

Syntax Analysis:

Bottom-up Parsing, Introduction to LR Parsing, Simple LR. More powerful LR parsers, Using ambiguous grammars, Parser Generators.

Self-learning topics: Automatic Parser Generator Using LEX and YACC tools.

Unit – III **10 Hours**

Syntax-Directed Translation:

Syntax-Directed definitions, Evaluation order for SDDs, Applications of Syntax-directed translation, Syntax-directed translation schemes

Unit – IV **10 Hours**

Intermediate Code Generation:

Variants of syntax trees, Three-address code; Types and declarations, Translation of expressions,
Control flow, Back patching, Switch statements, and Intermediate code for procedures **Self-learning topics:** Translation with Type checking

Unit – V **10 Hours**

Run-Time Environments and Code Generation:

Storage Organization, Stack allocation of space, Access to non-local data on the stack, Heap management, Introduction to garbage collection. Issues in the design of Code Generator, The Target language, Addresses in the target code, Basic blocks and Flow graphs, Optimization of basic blocks, A Simple Code Generator

Books

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman: Compilers-Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2007
2. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
3. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
4. Kenneth C Louden: Compiler Construction Principles & Practice, Thomson Education, 1997.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** and **explain** the different phases of Compilation process and Complier construction tools	L 2, L 3
2.	**Identify** and **explain** the precise rules (GRAMMAR) that prescribes the syntactic structure of programming language constructs. **Identify** and **classify** the parsing techniques. Design and implement Top Down parsing. And Bottom up parsing	L 2, 3, 4
3.	**Identify** the issues involved in the runtime environments.	L 3
4.	**Identify** the issues in the design of Code Generator and list the primary tasks	L 3
5.	**Identify** and **simplify** the use of ambiguous Grammar in the design of LR parsers. **Analyze** the Error recovery in LR parser	L 2, L 4
6.	**Compare** Syntax Directed Definitions and Syntax Directed Translation	L 1, L 3,

	Schemes. **List** the Attributed Definitions and **Identify** the evaluation orders for the Attributes	L 4
7.	**Design** Syntax Directed Translation Schemes to generate the Intermediate Representations Namely Syntax tree, Directed Acyclic Graph(DAG), Three Address Codes for Expressions, Control Flow, Switch statements and Procedures	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**
4.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
5.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
6.	Postgraduates can participate and succeed in competitive examinations.	**11**

	Course delivery methods		**Assessment methods**
1.	**Lecture**	1.	**Internal Assessment Test**
2.	**Power-Point Presentation**	2.	**Quiz**
3.	**Video**	3.	**Assignment/Seminar/Project**
4.		4.	

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	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. (Kindly MODIFY the changes in the pattern of SEE question paper, if required)

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Service Oriented Architecture

Course Code	15MCA543	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of step by step processes for service oriented analysis and service oriented design
2. Imparting an in depth exploration of service orientation as a distinct design paradigm, including a comparison to object orientation
3. Emphasizing on providing descriptions of over dozen key web services technologies and WS-* specifications
4. Acquainting the students with the guidelines for Service Oriented Business Modelling and the creation of specialized service abstraction layers

Pre-requisites:

1. A course on software engineering (MCA33).
2. A course on web programming (MCA12).
3. Practical exposure to web services.

Unit – I 12 Hours

Introduction and Evolution of SOA:

Fundamentals of SOA, Common characteristics of contemporary SOA, Common tangible benefits of SOA, A SOA timeline (from XML to Web Services to SOA), The continuing evolution of SOA (standards organizations and Contributing vendors), The roots of SOA (comparing SOA to Past Architectures).

Unit – II 12 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, Addressing, Reliable Messaging, Correlation, Policies, Meta data Exchange, Security, Notification and eventing

Self-Learning Topics: Implementation of SOA concepts like coordination, orchestration and choreography

Unit – III 10 Hours

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, Service Orientation and object orientation, Native Web Service support for service orientation principles

Unit – IV 10 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

Self-Learning Topics: Case Study on Orchestration.

Unit – V **08 Hours**

Business Process Design:

WS-BPEL Language basics, WS-Coordination overview, Service oriented business process redesign, WS-Addressing language basics, Ws-Reliable messaging language basics

Self-Learning Topics: Case Study on Infosys SOA

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. **Explain** Service Oriented Architecture and its fundamental concepts.	L2
2. **Explain** the concepts of choreography and orchestration	L2
3. **Compare** critically SOA to traditional architectures	L2
4. **Identify** common tangible benefits of SOA.	L3
5. **Distinguish** between service-orientation and object-orientation	L4
6. **Assess** the basics of WS-BPEL language	L5
7. **Discuss** common characteristics of contemporary SOA	L6

Program Outcome (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 a system, component or process as per needs and specifications	**4**
4. 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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Digital Marketing

Course Code	**15MCA544**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Adapting web marketing strategies and best practices
2. Understanding the concepts of web marketing
3. Defining web marketing goals; assigning resources and assessing growth opportunities
4. Keeping up-to-dates on best practices in web marketing

Pre-requisites:

NA

Unit – I **10 Hours**

Introduction to Digital marketing

Now and before of digital marketing - digital marketing for the 21st century, Importance and scope of digital marketing; How web sites work – dynamic, static, blogs: search engines and types of search engines – meta, crawler, directories; How to create a blog

Unit – II **10 Hours**

Concepts of Digital marketing

Search engine optimization marketing, Online advertisement, Affiliate, Social media, Analytics. Introduction to Search Engines: 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

Self-learning topics:

Unit – III **10 Hours**

Social Media

Introduction to social media, Examples of social media, Uses of social media, How companies use social media, Impact of social media in search Benefits of social media: Case studies of social media, SEO for social media, How to get started in social media. Social media profile creation and optimization

Self-learning topics:

Unit – IV **12Hours**

Advertisements

Online Ads – How online ads work : Interactive ads, Creative ads, Google Ad words, Online ad methods, Types of online advertisements, Face book ads, LinkedIn ads, Video ads, Text ads, Image ads, Local ads, Content network ads, Best practices, Campaign set up, Billing, Budget, Segment, Audience Effective Ads: Calculating ROI, Budget, How to choose your ad partner, Blogging for businesses Creative‘s& Content: Designing, Content development, Optimizing your ads, A/B testing, Conversion optimization, Landing page creation and optimization Face book strategy: Identify goals, Find Influencers, Understand tone (listening), Activation. How Face book advertisement works: The 3 Rs – Reporting, Results & Reallocation, Measuring ROI in Face book ads, Insights and Analytics for Face book Twitter Management: Twitter for business, Step by step instructions to Twitter, Key Definitions You Tube: You Tube branding, You Tube Ads, Getting started guide

Self-learning topics:

Unit – V **10 Hours**

Digital Marketing Management

Digital Marketing Management: Role of web marketing manager, Web marketing department structure, Roles and responsibilities, Job description, Targets, goals. Digital Marketing Plan: Goals, objectives, KPI's, Market research, Value creation process. Strategic web marketing plan, Budgeting, Channel. Online Reputation Management: Brand management, Tools to monitor online brand reputation, Communication online best practices, Online press releases, Online newspaper, magazine ads, Google, Yahoo news

Books

1. Zimmerman Jan, Sahlin Doug; Social media marketing, All-in-one for dummies, Wiley India
2. Dave Evans., Susan Bratton, (2008). Social Media Marketing: An Hour a Day. ,2nd edition, Wiley
3. Dave Evans., Susan Bratton, (2010). Social Media Marketing: The Next Generation of Business Engagement. Wiley
4. Your Google Game Plan for Success: Increasing Your Web Presence with Google AdWords, Analytics and Website Optimizer, Joe Teixeira, Wiley 2010

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 demonstrate an ability to design and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
4.	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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Software Project Management

Course Code	15MCA545	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of basic issues in software project management and highlights the major categories of activities that every project manager undertakes
2. Providing an overview of project planning and project monitoring & control
3. Exploring the concepts related to effort and duration estimation techniques.
4. Exploring risk management approaches with special focus on management of risks of schedule slippage using PERT
5. Providing an insight into the issues of contract management, human resource management, team structure and quality management

Pre-requisites:

A course on Software Engineering (MCA33).

Unit – I **10 Hours**

Introduction to Software Project Management: Project Definition, contract management, activities covered by software project management, overview of project planning, stepwise project planning **Project Evaluation:** Strategic assessment, technical assessment, cost benefit analysis.

Unit – II **10 Hours**

Activity Planning: Objectives, Project Schedule, Sequencing and scheduling activities, network planning models, forward pass, backward pass, activity float, shortening project duration.

Self-Learning Topics: Activity on arrow networks

Unit – III **11 Hours**

Risk Management: Risk management, nature of risk, types of risk, managing risk, hazard identification, hazard analysis, risk planning and control. **Monitoring**: creating framework, collecting the data, visualizing progress, cost monitoring, earned value, prioritizing monitoring, getting project back to target.

Unit – IV **10 Hours**

Control: change control, managing contracts, types of contract, stages in contract placement, typical terms of a contract, contract management, acceptance

Unit – V **8 Hours**

Managing people: introduction, understanding behavior, organizational behavior-background, selecting the right person for the job, instructions in the best methods, motivation.

Self-Learning Topics: The oldman, Hackmann job characteristics model.

Books

1. Bob Hughes, Mikecotterell, Software Project Management Tata Mcgraw Hill Fifth edition
2. Jalote, Software Project Management in Practice Pearson Education, 2002

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Define** the scope of 'Software Project Management'. Describe the problems and concerns of software project managers	L 1
2. **Analyze** the contents of a typical business plan and explain project portfolio management. Appraise the project planning approach in an organized step-by-step manner	L 4 & L5
3. **Design** a critical path and a precedence network for a project	L 6
4. **Identify** the factors putting a project at risk. Categorize and prioritize actions for risk elimination or containment	L 3
5. **Identify** the resources required for a project and make the demand for resources more even throughout the life of a project	L 3
6. **Design** a work plan and resource schedule to monitor the progress of projects.	L 6
7. **Distinguish** between the different types of contract. Outline the contents of a contract for goods and services	L 4
8. **Identify** some of the factors that influence people's behavior in a project environment. Improve group working and analyze the coordination needs of a project	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 design a system, component or process as per needs and specifications	**4**
4. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
5 Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
6. Postgraduates will be able to communicate effectively in both verbal and written form	**8**
7. 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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks:	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Supply Chain Management

Course Code	15MCA546	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing the strategic importance of good supply chain design, planning and operation for every firm and to train the students to identify how good supply chain management can be a competitive advantage, whereas weaknesses in the supply chain can hurt the performance of the firm
2. Explaining the key drivers of supply chain performance like facilities, inventory, transportation and information
3. Analyzing how these drivers may be used on a conceptual and practical level during supply chain design, planning and operations to improve performance
4. Training the students with practical managerial levers and concepts that may be used to improve supply chain performance
5. Utilizing analytical methodologies for supply chain analysis and understanding the managerial levers

Pre-requisites:

1. Software engineering (MCA33).
2. Management information system (MCA35).

Unit – I 12 Hours

Introduction and basic aspects of supply chain management

What is a Supply Chain, Decision phases in a supply Chain, Process view of a Supply Chain, The importance of Supply Chain Flows, Examples of Supply Chains, Competitive and Supply Chain strategies, Achieving strategic fit, Expanding strategic scope, Drivers of Supply Chain Performance, A framework for structuring drivers, Facilities, Inventory, Transportation, Information, Obstacles to achieve strategic fit, The role of distribution in the Supply Chain, Factors influencing distribution network design, Design options for a distribution network, The value of distributors in the Supply Chain, Distribution Networks in practice.

Self-Learning Topics: Case Study on gateway, DELL and Wallmart

Unit – II 12 Hours

Network Design, Demand Forecasting, Aggregate Planning

The role of network design in the Supply Chain, Factors influencing Network design Decisions, A framework for Network Design Decisions, The impact of uncertainty on Network design, The role of forecasting in a Supply Chain, Characteristics of forecast, Components of a forecast and forecasting methods, Basic approach of Demand forecasting, Time series forecasting methods, Measures of forecast errors, The role of aggregate planning in a supply Chain, The aggregate planning problem, Aggregate planning strategies

Self-Learning Topics: Evaluating Network Design Decisions using Decision Trees.

Unit – III **8 Hours**

Inventory Management

The role of cycle inventory in a supply Chain; Economies of scale to exploit fixed costs, quantity discounts; Short-term discounting; Managing multi-echelon cycle inventory; Estimating cycle inventory related costs in practice

Unit – IV **12 Hours**

Transportation, Pricing and Revenue Management, Coordination

The role of transportation in the Supply Chain, Factors affecting transportation decisions, Modes of transportation and their performance characteristics, Design options for a transportation network, Trade-offs in transportation design, Tailored transportation, Routing and scheduling in transportation, Making transportation decisions in practice. The role of revenue management in Supply Chain, revenue management for multiple customer segments, perishable assets, seasonal demand, and bulk and spot contracts, Using revenue management in practice, Lack of Supply Chain coordination and Bullwhip effect, Effect of lack of coordination on performance, Obstacles to coordination in the Supply Chain, managerial levers to achieve coordination, Building strategic partnerships and trust within a supply Chain, Achieving coordination in practice

Unit – V **8 Hours**

IT, Internet and Supply Chain

The role of IT in the Supply Chain, The Supply Chain IT framework, CRM, Internal SCM, Supplier Relationship Management, The transaction management foundation, The future if IT in SCM, Supply Chain It in practice, The role of E-Business in Supply Chain, The E-Business framework, The B2B addition to the E-Business framework, E-Business in practice

Books

1. Sunil Chopra and Peter Meindl, Supply Chain management Strategy, Planning and Operation, 3nd edition, Prentice – Hall of India 2008
2. David Simchi-Levi, Philp Kaminky, Edith Simchi-Levi: Designing and Managing The Supply Chain Concepts, Strategies & Case Studies, 3rd Edition, Tata McGraw Hill, 2003
3. R.P. Mohanty, S.G. Deshmukh: Supply Chain Management Theories & Practices, Bizmantra, 2005
4. Rahul V. Altekar: Supply Chain Management Concepts and Cases, PHI, 2005
5. M Martin Christopher: Logistics and Supply Chain Management, 2nd Edition, Pearson Education, 1998.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** the impact of supply chain decisions on the success of the firm	L 2
2.	**Identify** the drivers of supply chain performance and **explain** the role each driver plays in creating strategic fit between the supply chain strategies.	L 2, L3
3.	**Identify** the key factors to be considered when designing a distribution network **Discuss** the strengths and weaknesses of various distribution options	L 3, L 6
4.	**Define** and **discuss** the role of forecasting for both an enterprise and a	L 1, L 6

	supply chain	
5.	**Explain** the basic trade-offs to consider when creating an aggregate plan. **Formulate** and solve basic aggregate planning problems	L 2, 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 skills to use modern software tools and technology to build and test applications	**6**
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	**Average of best two IA tests out of three**	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	**Total Marks**
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Digital Image Processing

Course Code	15MCA547	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of the basics of Digital Image Processing and its applications in fast evolving technological world.
2. Explaining the fundamentals theories and techniques of digital image processing.
3. Developing an understanding of basic image processing operations.
4. Exposing the students to current applications in the field of digital image processing.

Pre-requisites:

1. Digital Systems and Computer Organization (MCA13)
2. Discrete Mathematical Structures (MCA15)

Unit – I — 10 Hours

Introduction

Introduction to Digital Image Processing, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing. Components of an Image Processing System. Image Sampling and Quantization. Some Basic Relationships Between Pixels. Linear and Nonlinear Operations

Unit – II — 12 Hours

Image Enhancement in the Spatial Domain and Frequency Domain

Some Basic Gray Level Transformations. Histogram Processing. Enhancement Using Arithmetic/Logic Operations. Basics of Spatial Filtering. Smoothing Spatial Filters. Sharpening Spatial Filters. Combining Spatial Enhancement Methods, Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters.

Self-Study Topics: Homo-morphic Filtering

Unit – III — 10 Hours

Morphological Image Processing and Image Segmentation

Dilation and erosion, opening and closing, Hit-or-Miss transformations, basic morphological algorithms, Detection of discontinues, edge linking and boundary detection, thresh holding, region –based segmentation

Unit – IV — 10 Hours

Representation and Descriptors

Representation. Boundary Descriptors. Regional Descriptors. Use of Principal Components for Description. Relational Descriptors

Unit – V **10 Hours**

Use of Image Processing in Pattern Recognition

Introduction to the tools of Matlab and Open CV.

Self-Study Topics: Case study on Object Identification, Biometrics and Content Based Image retrieval.

Books

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, 2002
2. Anil K Jain, Fundamental of Digital Image Processing, Prentice Hall of India, 2004
3. William K Pratt, Digital Image Processing PIKS Scientific Inside, 4th Edition, Wiley

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** the basic elements and applications of image processing	L 2
2.	**Apply** histogram equalization for image enhancement	L 3
3.	**Utilize** Matlab to implement different image processing tasks	L 3
4.	**Analyze** image sampling and quantization requirements and implications	L 4
5.	**Design** and implement two-dimensional spatial filters for image enhancement	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 and conduct experiments, analyze and interpret data	**3**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Elective Group-4

NoSQL

Course Code	**15MCA551**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours

Course learning objectives

1. Introducing the concepts of big data and need of NoSQL.
2. Introducing different flavors of NoSQL like Redis, Hyper Table, MongoDB/ CouchDB/ Cassandra. Store.
3. Accessing the data using cloud, implement MapReduce to store using Hive, analyze the Big Data using Apache Pig High level language
4. Designing, storing and accessing the Big Data using NoSQL
5. Designing and Developing web application using NoSQL
6. Interpreting the administrative tasks and implementing administration of NoSQL while maintaining the web applications

Pre-requisites:

1. A course on Database management system (15MCA22).
2. Knowledge of database RDBMS

Unit – I — 10 Hours

Introduction to NoSQL

Definition of NoSQL, History of NoSQL and Different NoSQL products, Exploring MondoDB Java/Ruby/Python, Interfacing and Interacting with NoSQL

Unit – II — 12 Hours

NoSQL Basics

NoSQL Storage Architecture, CRUD operations with MongoDB, Querying, Modifying and Managing NoSQL Data stores, Indexing and ordering datasets (MongoDB/CouchDB / Cassandra)

Unit – III — 10 Hours

Advanced NoSQL

NoSQL in CLOUD, Parallel Processing with Map Reduce, BigData with Hive

Self-learning topics: IBM Hadoop Introduction.

Unit – IV — 10 Hours

Surveying Database Internals, migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL-Coexistence.

Self-learning topics: Choosing among NoSQL Flavors, Tools and Utilities

Unit – V **10Hours**

Developing Web Application with NoSQL **and** NoSQL **Administration** PHP and MongoDB, Python and MongoDB, Creating Blog Application with PHP, NoSQL Database Administration

Books

1. "Professional NOSQL" Shashank Tiwari, 2011, WROX Press
2. 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.	**Define** and **Express** the limitations of RDBMs, need of NoSQL for Big Data, different NoSQL products available in market	L 1
2.	**Apply** CRUD operations with MongoDB, storing data and accessing data with MongoDB/CouchDB/Cassandra	L 3
3.	**Construct** MapReduce –parallel programming model for distributed processing on large data sets, on a cluster of computers	L 3
4.	**Create** Apache Hive –data warehouse infrastructure on Hadoop and Analyze Big Data with Hive using Apache Pig	L 6
5.	**Develop** Web applications using NoSQL, Python and 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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Web 2.0 and Rich Internet Applications

Course Code	15MCA552	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Training a learner to initiate client-server communication using various Asynchronous JavaScript and XML (Ajax) techniques and patterns
2. Enabling a learner to implement web applications using Hypertext Preprocessor (PHP), Cascading Style Sheets (CSS), Extensible Markup Language (XML), and Document Object Model (DOM) using Ajax.
3. Focusing on knowledge of Flex Framework, Flex technologies and designing Rich Internet Applications rapidly using Flex by assembling off-the-shelf components including: User Interface (UI) controls, layout containers, and data models
4. Using Macromedia Flex Markup Language (MXML), Actionscript, and the Flex class library to model data, validate data, format data, and manage *states* in a Flex Application

Pre-requisites:

1. Web Programming (15MCA12).
2. Internet Web Programming (15MCA43)

Unit – I **10 Hours**

Introduction to Ajax Technologies, Ajax Patterns and JavaScript Object Notation

Birth of Ajax, The Evolution of the Web, The Real Ajax, Ajax Principles, Technologies Behind Ajax, Users of Ajax, Confusion and Controversy, Ajax and Web 2.0. Hypertext Transfer Protocol (HTTP) Primer, Ajax Communication Technique: The Hidden Frame Technique, Hidden Frame Pattern, Hidden Frame GET Request, Hidden Frame Post Request. Introduction to Hidden iFrames, Hidden iFrame GET Request, Hidden iFrame POST Request, Advantages and Disadvantages of Hidden Frames. Creating Ajax Applications: Creating XMLHttpRequest objects, Configuring XMLHttpRequest objects, Handling data downloads from the server using anonymous functions, Fetching text data from the server, Passing data to the server using Ajax and the GET and PUT HTTP methods, Fetching Extensible Markup Language (XML) data from the server and decoding that data, Fetching XML data from the server by passing data to the server.

Communication Control Patterns: Predictive Fetch, Submission Throttling, Periodic Refresh, Multistage Download, Fallback Patterns. JavaScript Object Notation (JSON): Array Literals, Object Literals, Mixing Literals, JSON Syntax, JSON Encoding. Decoding, JSON versus XML

Unit – II **10 Hours**

Full Throttle Ajax with Extensible Markup Language (XML) and Cascading Style Sheets (CSS)

Handling multiple XMLHttpRequest requests, using two XMLHttpRequest requests, using an array of XMLHttpRequest requests, using inner functions and multiple XMLHttpRequest requests, Handling JavaScript sent from server, Overcoming browser caching.

Working with XML in JavaScript, navigating through XML documents, Retrieving XML element data, Retrieving XML element attribute data. Getting text noticed with CSS, Styling fonts with CSS, Styling colors with CSS, setting absolute positions using CSS

Unit – III **10 Hours**

Ajax with Hypertext Preprocessor (PHP) and Document Object Model (DOM)

Displaying all the data in a form, working with PHP server variable, sending form data in arrays, Creating single-page PHP applications, Validating numbers, Validating text.

Introducing the Document Object Model (DOM), Appending elements using the DOM, replacing elements using the DOM, Handling Ajax timeouts

Self-learning topics: Downloading images with Ajax

Unit – IV **12 Hours**

Understanding Flex Environment, Layouts, Macromedia Flex Markup Language (MXML) and ActionScript

Introduction: Understanding Flex Application Technologies, Using Flex Elements, Working with Data Services (Loading Data at Runtime), The Differences between Traditional and Flex Web Applications, Understanding How Flex Applications Work, Understanding Flex and Flash Authoring. Building Applications with the Flex Framework: Using Flex Tool Sets, Creating Projects, Building Applications, Deploying Applications. Framework Fundamentals: Understanding How Flex Applications Are Structured, Loading and Initializing Flex Applications, Understanding the Component Life Cycles, Loading One Flex Application into Another Flex Application, Differentiating Between Flash Player and the Flex Framework, Caching the Framework, Understanding Application Domains, Localization, Managing Layout: Flex Layout Overview, Making Fluid Interfaces, Putting It All Together.

Macromedia Flex Markup Language (MXML): Understanding MXML Syntax and Structure, Making MXML Interactive Working with UI Components: Understanding UI Components, Buttons, Value Selectors, Text Components, List-Based Controls, Pop-Up Controls, Navigators, Control Bars, and Customizing Application. Appearance: Using Styles, Skinning components, Customizing the preloader, Themes, Runtime CSS ActionScript: Using ActionScript, MXML and ActionScript Correlations, Understanding ActionScript Syntax, Variables and Properties, Inheritance, Interfaces, Handling Events, Error Handling, Using XML

Unit – V **10 Hours**

Working with States, Data Models and Data Binding

Managing State: Creating States, Applying States, Defining States, Adding and Removing Components, Setting Properties, Setting Styles, Setting Event Handlers, Using Action Scripts to Define States, Managing Object Creation Policies, Handling State Events, Understanding State Life Cycles, When to Use States. Using Effects and Transitions: Using Effects, Creating Custom Effects, Using Transitions, Creating Custom Transitions.

Working with Data: Using Data Models, Data Binding, Enabling Data Binding for Custom Classes, Data Binding Examples, Building data binding proxies. Validating and Formatting Data: Validating user input, Formatting Data.

Self-learning topics: Client Data Communication in Flex Application.

Books

1. Nicholas C Zakasetal: Processional AJAX, Wiley India Publications
2. Steven Holzner: Ajax A Beginners' Guide, Tata McGraw Hill, 2011.
3. ChaficKazon and Joey Lott: Programming Flex 3, O'Reilly, 2011

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** history, principles and technologies behind Ajax	L 2
2.	**Assess** the management of *states* in Flex Application	L 5
3.	**Develop** Ajax applications using Hidden Frames and XMLHttpRequest object in conjunction with PHP, XML, CSS and DOM	L 6
4.	**Develop** Rich Internet Applications using Flex Framework and Flex Elements like MXML and ActionScript	L 6
5.	**Design** Flex Application using Data Models and Data Binding	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**
4.	Postgraduates will demonstrate an ability to design a system, component or process as per needs and specifications	**4**
5.	Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
6.	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	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Storage Area Networks

Course Code	15MCA553	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of problem domain, Analyzing and designing the solution for a given problem with representation of the solution in the form of Networks
2. Exploring fundamental concepts and introducing Key Challenges in Managing Information, Information Lifecycle Components of Storage System Environment, Disk Drive Components, Disk Drive Performance

Pre-requisites:

1. computer network (MCA31).

Unit – I 12 Hours

Introduction to Information Storage and Management, Storage System Environment, Data Protection, Intelligent Storage system: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle Components of Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance. Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares Components of an Intelligent Storage System, Intelligent Storage Array.

Unit – II 12 Hours

Direct-Attached Storage(DAS), SCSI, and Storage Area Networks, NAS, IPSAN: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies. **NAS, IP SAN:** General – Purpose Service vs. NAS Devices, Benefits of NAS, NAS File I / O, Components of NAS, NAS Implementations, NAS File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. iSCSI, FCIP.

Unit – III 8 Hours

Content-Addressed Storage, Storage Virtualization: Fixed Content and Archives, Types Business Continuity of Archive, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples. Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualizations Configurations, Storage Virtualization Challenges, types of Storage Virtualization

Unit – IV 8 Hours

Business Continuity, Backup and Recovery: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and restore Operations, Backup

Topologies, Backup in NAS Environments, Backup Technologies

Unit – V **12 Hours**

Local Replication, Remote Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Modes of Remote Replication, Remote Relocation Technologies, Network Infrastructure

Self-Learning Topics: Storage Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution

Books

1. G. Somasundaram, Alok Shrivastava (Editors): Information Storage and Management: EMC Education Services, Wiley- India, 2009
2. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003
3. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003
4. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Develop** Proficiency in Storage fundamentals and Storage Architecture	L 6
2. **Evaluate** Network Attached Storage - NAS protocols, Live configuration of NAS	L 5
3. **Apply** Backup, Data Replication, Storage Virtualization and Storage systems Monitoring Alerts, Reports	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**
6. 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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Information and Network Security

Course Code	15MCA554	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Providing a clear understanding of fundamentals of Cryptography
2. Exploring knowledge on standard algorithms used to provide confidentiality, integrity and authenticity
3. Describing the various key distribution and management schemes
4. Implementing encryption techniques to secure data in transit across data networks
5. Designing security applications in the field of Information technology and learning Electronic mail security

Pre-requisites:

1. Computer networks course (MCA31).
2. Background in system programming (MCA25),
3. Statistics and probability are helpful

Unit – I **10 Hours**

Planning for Security and Security Technology-1:

Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan.

Introduction; Physical design; Firewalls; Protecting Remote Connections

Unit – II **11 Hours**

Security Technology– 2 and Cryptography:

Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools.

Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems

Self-Learning Topics: Access control devices

Unit – III **10 Hours**

Introduction to Network Security, Authentication Applications:

Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs. Kerberos, X.509 Directory Authentication Service.

Unit – IV **11 Hours**

Electronic Mail Security and IP Security:

Pretty Good Privacy (PGP); S/MIME.

IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

Unit – V **10 Hours**

Web Security:

Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS);

Secure Electronic Transaction (SET).
Self-Learning Topics: Network management security.

Books

1. Principles of Information Security – Michael E. Whitman and Herbert J. Mattord, 2nd Edition, Thomson, 2005
2. Applications and Standards – Network Security Essentials, William Stallings, Pearson Education, 2000

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify** the security issues in the network and resolve it	L 3
2. **Analyze** the vulnerabilities in any computing system and hence be able to design a security solution	L 4
3. **Evaluate** security mechanisms using rigorous approaches, including theoretical	L 5

Program Outcome (POs)	**PO No.**
1. Postgraduates will demonstrate knowledge of mathematics, computer applications, and management	**1**
4. Postgraduates will demonstrate an ability to analyze and build computer applications for multiple domains	**5**
8. 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. Internal Assessment Test
2. Power-Point Presentation	2. Quiz
3. Video	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	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Mobile Ad-hoc Sensor Network

Course Code	15MCA555	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Introducing the design issues in ad hoc and sensor networks.
2. Emphasis on the different types of MAC protocols,
3. Guiding about the different types of ad hoc routing protocols.
4. Exposing the TCP issues in ad hoc networks.
5. Introducing the architecture and protocols of wireless sensor networks.

Pre-requisites:
A course on computer network (MCA31)

Unit – I 12 Hours

Introduction:
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc Networks (MANETs) and wireless sensor networks (WSNs) concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

Unit – II 10 Hours

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS
Issues in designing a MAC Protocol- Classification of MAC Protocols-Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multichannel MAC-IEEE 802.11

Unit – III 10 Hours

ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS
Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand).
Self-Learning Topics: hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc Wireless Networks**.**

Unit – IV 10 Hours

Introduction to Wireless Sensor Networks(WSN)
Introduction, Basic overview to the Technology, Applications of wireless sensor Networks, Basic Wireless Transmission Technology and Systems.

Unit – V 10 Hours

MAC and Routing Protocols
Introduction to MAC Protocols, Fundamentals of MAC Protocols, Introduction to Routing Protocols, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSN, Routing strategies in Wireless Sensor Networks
Self-Learning Topics: Directed Diffusion, Geographical Routing

Books

1. C Siva Ram Murthy and B. S. Manoj "Ad Hoc Wireless Networks Architectures and Protocols" Pearson publications 2007
2. Tonguz and Ferrari, "AD HOC Wireless Networks A communication – Theoretic perspective" Wiley 2006
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks Technology, Protocols and Applications" Wiley publications 2015

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **List** the advantages and Disadvantages of using Protocols	L 1
2. **Explain** the objectives and functions of Modern Network Systems	L 2
3. **Explain** the Ad-Hoc networks	L 2
4. **Identify** MAC Protocols	L 3
5. **Apply** the Simulation and Modelling of Protocols in creating wireless mobile Networks	L 3
6. **Compare** simple networks with Ad-Hoc networks	L 2

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 an ability to design a system, component or process as per needs and specifications	**4**
4. Postgraduates will be able to communicate effectively in both verbal and written form.	**8**
5. Postgraduates can participate and succeed in competitive examinations	**11**

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	Average of best two IA tests out of three	Average of two assignments/ Course Seminar/ Course Project	Quiz	Total Marks
Maximum Marks: 50	30	10	10	50

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

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Professional Communication and Ethics

Course Code	**15MCA556**	**Credits**	04
Course type	GE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	52	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Equipping the students with skill set to face the challenges in communication, primarily in a technical milieu by covering the four dimensions of communications skills, namely listening, speaking, reading and writing
2. Introducing the basics of communication, barriers in communications, use of technology in communication and active listening
3. Learning effective presentation strategies and skills to give seminars/presentations, face interviews and participate in group discussions
4. Emphasizing on the constituents of effective writing and reading comprehensions, enabling students to improve on their vocabulary, sentence construction, paragraph development and reading strategies
5. Implementing various writing strategies to write various business letters, job applications, resume, and e-mail messages
6. Introducing Ethics in Engineering with emphasis on moral problems engineers face in the corporate setting
7. Stimulating critical and responsible reflection on the moral issues surrounding engineering practice and providing the conceptual tools necessary for pursuing those issues

Pre-requisites:

Fundamentals of English Language and English Grammar.

Unit – I 8 Hours

Basics of Technical Communication

Introduction to Communication, The Process of Communication, Language as a Tool of Communication, Levels of Communication, The Flow of Communication, Communication Networks, The Importance of Technical Communication, Definition of Noise, Classification of Barriers, Impact of Technology, Software for Creating Messages, Software for Writing Documents, Software for Presenting Documents and Transmitting Documents

Unit – II 12 Hours

Oral Forms in Communication

Active Listening: Introduction, Types of Listening, Traits of good Listener, Active Versus Passive Listening, Implications of Effective Listening. Effective Presentation Strategies: Introduction, Purpose, Analyzing Audience and Locale, Organizing Contents, Preparing Outline, Visual Aids, Nuances of Delivery, Kinesics, Proxemics, Paralinguistics, Chronemics. Interviews and Group Discussion: Introduction to Interviews and Group Discussion, Objectives of Interviews, Types of Interviews, Job Interviews, Organizational Group Discussions, Group Discussion as a Part of a Selection Process.

Unit – III 12 Hours

Constituents of Effective Writing and Professional Writing

Words and Phrases: A Brief History of Words, Dictionary and Thesaurus, Elements of Style, Guidelines for Effectiveness, Sentence Construction, Paragraph Development, Central Components of a Paragraph, Length of Paragraph and Techniques for Paragraph Development. The Art of Condensation: Introduction, Steps to Effective Precise Writing, Samples and Guidelines. Routine Business Letters: Letter Writing Skills, Letter Writing Process, Form and Structure, Style and Tone, Inquiry Letters, Letters Placing Orders, Instruction Letters, Letters Urging Action, Complaint and Adjustment Letters. Resumes and Job Applications: Employment Communication, Writing Resumes, Job Application Letters, Closing of Letters. Email-Messages: Principles and Fundamentals, Formatting E-mail Messages, Standard E-mail Practices, E-mail Writing Strategies

Self-Learning Topics: Writing Sales Letters, Business Memos and Technical Articles.

Unit – IV **7 Hours**

Reading and Language Comprehension

Reading – A Communicative Process, Reading with Purpose, Reading Different Kinds of Text, Active and Passive Reading, Reading Speed, Reading Skills, Vocabulary Skills, Eye Reading and Visual Perception, Prediction Techniques, Scanning Skills, Skimming Skills, Intensive Reading Skills

Unit – V **13 Hours**

Ethics in Engineering

What is Engineering Ethics? Why Study Engineering Ethics? Professions and Professionalism, Professional Ideals and Virtues, Theories about Right Action, Engineering as Experimentation, Engineers as Responsible Experimenters, Code of Ethics, Collegiality and Loyalty, Whistle-Blowing and Computer Ethics

Self-Learning Topics: Engineers as Managers, Consultants and Leaders

Books

1. Meenakshi Raman, Sangeeta Sharma: Technical Communication Principle and Practice, Oxford University Press
2. M Ashraf Rizvi: Effective Technical Communication, Tata McGraw-Hill.
3. Mike W. Martin, Ronald Schinzinger: Ethics in Engineering, Third Edition, Tata McGraw-Hill Publishing Company Limited

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** Process, Levels and Flow of Communication	L 3
2.	**Evaluate** Barriers of Communication and the impact of Technology in communication	L 5
3.	**Apply** the traits of a good listener and effective presentation strategies in oral communication	L 3
4.	**Compose** effective writing using appropriate words, phrases and the art of condensation	L 6
5.	**Improve** the art of reading using reading techniques	L 6
6.	**Construct** effective Business Letters, Resumes, Job Applications, and E-mail messages	L 6
7.	**Analyze** the role of Engineers with their social responsibilities to reflect critically on the moral dilemmas they will confront in their profession	L 4

	Program Outcome of this course (POs)	PO No.
1.	Postgraduates will demonstrate knowledge of professional and ethical responsibilities.	**7**
2.	Postgraduates will be able to communicate effectively in both verbal and written form	**8**
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. Internal Assessment Test
2. Power-Point Presentation	2. Quiz
3. Video	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	30	10	10	50

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

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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Pattern Recognition

Course Code	15MCA557	Credits	04
Course type	GE	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	52	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Fundamentals of pattern recognition system
2. Feature extraction and pattern classification algorithms.
3. Unsupervised classification or clustering techniques.
4. Applications of pattern classification algorithm for a pattern recognition problem

Pre-requisites:

1. Computer programming language(C) (MCA14).
2. Discrete Mathematics (MCA15).

Unit – I **13 Hours**

Introduction and Bayesian Decision Theory: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation. Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the norm.

Unit – II **13 Hours**

Maximum-Likelihood And Bayesian Parameter Estimation and Non-Parametric Techniques:

Introduction; maximum-likelihood estimation; Bayesian Estimation;
Bayesian parameter estimation: Gaussian Case, general theory;
Hidden Markov Models. Density Estimation; Parzen windows; kn Nearest- Neighbor Estimation; The Nearest-Neighbor Rule; Metrics and Nearest-Neighbor Classification

Unit – III **6 Hours**

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Nonseparable Behavior; Minimum Squared-Error procedures

Self-learning topics: The Ho-Kashyap procedures

Unit – IV **13Hours**

Stochastic Methods and Non-Metric Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Method Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods

Unit – V **7 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiably; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering.

Self-learning topics: Criterion Functions for Clustering.

Books

1. Richard O. Duda, Peter E. Hart, and David G.Stork "Pattern Classification", 2/E, Wiley-Interscience, 2001
2. Earl Gose, Richard Johnsonbaugh, Steve Jost "Pattern Recognition and Image Analysis" - Pearson Education, 2007
3. V Susheela Devi, M NarsimhaMurthy, Pattern Recognition (An Introduction), V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-`3,2011.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**List** learning algorithms for unsupervised tasks	L 1
2.	**Construct**, document and present a literature review on a topic related to Machine Learning and Pattern Recognition	L 3
3.	**Identify** areas where Pattern Recognition and Machine Learning can offer a solution	L 3
4.	**Discuss** the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems	L 6
5.	**Discuss** some discriminative, generative and kernel based 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 skills to use modern software tools and technology to build and test applications	**6**
4.	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. Internal Assessment Test
2. Power-Point Presentation	2. Quiz
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Components	Average of best two IA tests out of three	**Average of two assignments/ Course Seminar/ Course Project**	**Quiz**	Total Marks
Maximum Marks: 50	30	10	10	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

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 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

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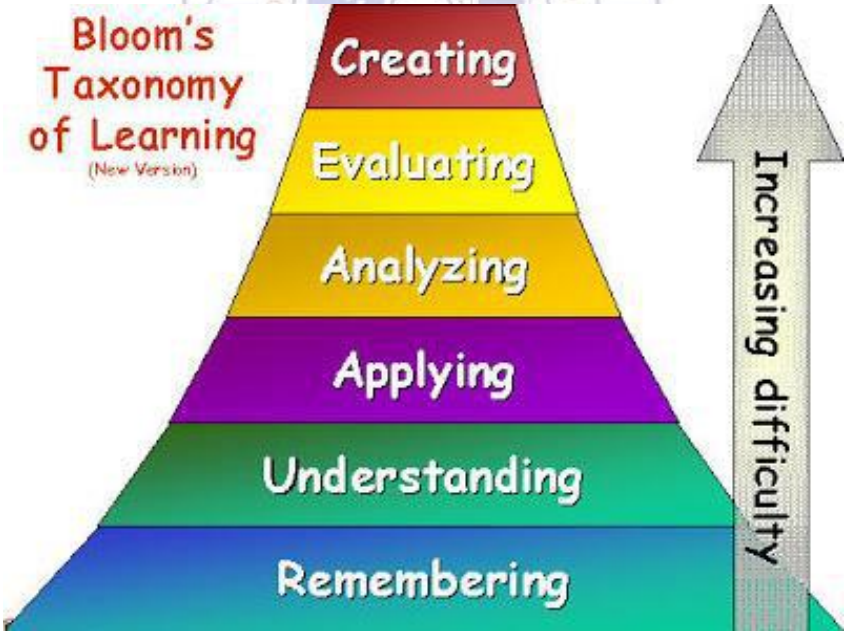
Bloom's Taxonomy of Learning Objectives

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

VI Semester

Sl. No.	Course Code	Course Title	Category	L-T-P	Credits	Contact Hours/ Week	CIE Marks	SEE Marks		Total Marks
								Demonstration, Presentation and Viva	Dissertation	
1	15MCA61	Internship	CC	NA	2	Full Time	50	--	--	50
2	15MCA62	Seminar	SC	0-2-0	2	2	50	--	--	50
3	15MCA63	Project Work-2	CC	NA	12	Full Time	50	100	50	200
4	15MCA64	Certification-1	CT	NA	1	1	25	--	--	25
5	15MCA65	Certification-2	CT	NA	1	1	25	--	--	25
			Total	NA	18	--	200	100	50	350

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

15MCA64 and 15MCA65: Certification Courses

Please refer to the III (Third) semester Scheme for guidelines

Internship

Course Code	15MCA61	**Credits**	2
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	N/A	**SEE Marks**	--
Total Hours:	Full Time	**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. The Internship should be carried out in Industry/R&D Labs/ Institutions.
3. Students should submit Internship offer letter to DPGC committee before starting of the Internship.
4. After completion of Internship students have to give presentation and submit report before the end of the first month of 6th semester to the department.
5. Report and Presentation should consists of following information:
    1. Brief history and profile of the company
    2. Industry Training
    3. Technology Learnt
    4. Programming Skills developed
    5. Outcome of 3 Weeks of Internship
    6. Problem Statement
    7. Technologies Used
    8. Modules developed
    9. Skills set developed

6. **Evaluation Method**: Internship for M.C.A. should be evaluated for 50 Marks as CIE. CIE includes 20 marks for external guide (Industry person), 20 marks for report, assessed by internal guide and 10 marks for presentation.

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Seminar

Course Code	15MCA62	**Credits**	2
Course type	SC	**CIE Marks**	50 marks
Hours/week: L-T-P	0-2-0	**SEE Marks**	--
Total Hours:	12	**SEE Duration**	--

Course learning objectives

1. Providing a systematic and independent study of the state of the art topics in a broad area of his / her specialization.
2. To get acquainted thoroughly with the broad area of the student's final year project work and serve as necessary groundwork for the successful carrying out of the project work.
3. Understand aspects of a seminar presentation.
4. Focusing on organization of the material.
5. Learning technical writing.
6. Assess the communication capability of the student to present a technical topic.
7. To train students to face audience and present their ideas and thus creating in them self-esteem and courage that are essential for an IT Professional.

Guidelines

1. This course is mandatory for all students pursuing MCA degree.
2. Seminar topics to be chosen from any reputed journals like IEEE/ Springer/Elsevier (Science Direct)/Scopus/DBLP indexed conference papers etc.
3. The CIE marks for Seminar is 50. This factor is to be monitored by the consent of the guide along with panel.

Distribution of marks:

Topic relevance	Content	Presentation	Impact factor/significance of conference / journal
5	20	15	10

Note: minimum duration for presentation is 12 minutes + 3 minutes QA

4. Total credits for seminar (MCA62) are 2.
5. Student must / should select the topic for the seminar from the domain in which he/she is doing project work for the final semester. (MCA63)
6. Students should present the seminar on cutting edge/emerging/state of the art technologies in the field of Computer Science and Applications.

7. Total contact hour for seminar is 12. The student has to contact his/ her guide and discuss the topic and the publication or presentation details.
8. Guide has the authority to disapprove the topic selected (if found incompetent).
9. Students must submit seminar topic to the guide before second phase of evaluation of project work-2 (MCA63).
10. The student must then prepare a research paper on selected topic and present / publish it in any national / International conference or journal.
11. The student must present the seminar to the panel in the last phase of Project Work-2 evaluation.
12. At the time of evaluation, student should submit all the details viz. conference certificate or hard copy of the paper published.
13. Panel has the full authority to evaluate the seminar.
14. Final decision regarding the seminar is held reserved by DPGC.
15. Duration of the seminar should be approximately 45 minutes.
16. Student should submit the write up on seminar topic containing at least 10 pages.

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Identify** and **explain** aspects of a seminar presentation	L2, L3
2. **Evaluate** literature survey	L5
3. **Explain** Presentation of slides	L2
4. **Design** and **develop** the material in organized manner	L6
5. **Elaborate** active involvement in seminar.	L6
6. **Summarize** with a technical report.	L2

	Program Outcome of this course (POs)	**PO No.**
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**2**
2.	Postgraduates will demonstrate an ability to identify, formulate and solve engineering problems.	**3**
3.	Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications	**6**
4	Postgraduates will be able to communicate effectively in both verbal and written form.	**8**
5	Postgraduates will develop confidence for self-education and ability for life-long learning	**10**
6	Postgraduates can participate and succeed in competitive examinations	**11**
7	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):

Components	Topic relevance	Content	Presentation	Impact factor/significance	Total Marks
Maximum Marks: 50	5	20	15	10	50
➢	➢ Submission and certification of seminar report to qualify for SEE. ➢ **Minimum marks required to qualify for SEE: 25**				

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Project Work-2 (Project)

Course Code	15MCA63	**Credits**	12
Course type	CC	**CIE Marks**	50 marks
Hours/week: L-T-P	N/A	**SEE Marks**	150 marks
Total Hours:	Full Time	**SEE Duration**	3 Hours for 200 marks

Pre-requisites: Software Development tools & technologies, Programming languages.

Guidelines

1. **The Project should be carried out in his/her Institution or any Industry/R&D Labs based on relevant tools and techniques learned in MCA courses / internship.**
2. **Project should be real time work, project for minimum 12 weeks of 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. **Seminars / presentation should be given on Synopsis, Software Requirement Specifications, Design and Project Completion levels.**
5. **Students should submit project offer letter to department project committee before starting of the project.**
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 required to show their project code demo along with their power point slide show during their viva-voce exams as an added advantage.**
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 Head of the Department with approval of the guide within Three weeks from the commencement of 6th semester.**
10. **Submission and certification of project report is compulsory to qualify for SEE.**
11. **Student has to submit the Weekly work progress report (Fig.1) duly signed with seal by External Guide, to the department.**
12. **Failing to meet the above process by candidate / external guide lead to disqualification of the candidate's project work-2 (15MCA63) 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 table caption 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.

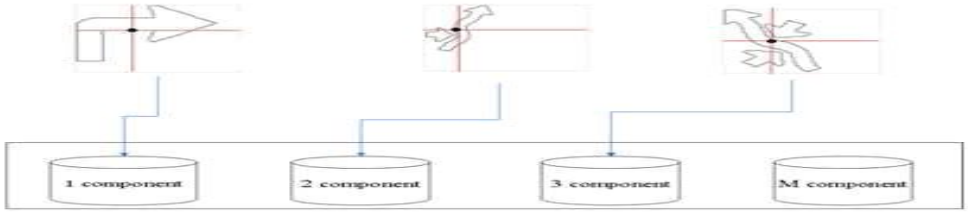

Fig 1.1. The last sentence of a figure caption should generally end without a period

6. Formulas

Displayed equations or formulas are centered and set on a separate line (with an extra line or halfline 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 2016-2017

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. For citations in the text please use square brackets and consecutive numbers: [1], [2], [3] etc.

10. Page Numbering

Reports must be printed with page numbers on the top right corner.

11. The total number of reports to be prepared are three
· One copy to the concerned guide
· One copy for University
· One copy to candidate
· Two CD's having soft copy of Project report (for department purpose)
12. Before taking the **final printout**, the approval of the concerned guide is mandatory and suggested corrections, if any, must be incorporated.

13. 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)

14. 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) forms 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 is **to be paid 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 guide one week before the scheduled phase dates.

Weekly progress Report Format:

Intern's Name: USN:	External Guide Name:
Week Num:	Week Period from Date:_____To Date: _____
Tasks Performed:	
Student Signature Date: Signature of Internal Guide	Signature of External Guide with Company Seal Signature of HOD

Fig.1

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Demonstrate effective user interfaces for the software application	L6
2.	Develop applications using various tools and technologies, frameworks	L3
3.	Build enterprise applications using database and server-side technologies	L6
4.	Test and deploy competent mobile/console/web development solutions	L6
5.	Apply UML techniques to build applications	L3

Program Outcome of this course (POs)		PO No.
1.	Postgraduates will demonstrate knowledge of mathematics, computer applications, and management.	**PO1**
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 to analyze and build computer applications for multiple domains.	**PO5**

4. Postgraduates will demonstrate skills to use modern software tools and technology to build and test applications. **PO6**
5. Postgraduates will demonstrate knowledge of professional and ethical responsibilities. **PO7**
6. Postgraduates will be able to communicate effectively in both verbal and written form. **PO8**
7. Postgraduates will show the understanding of impact of engineering solutions on the society as a successful entrepreneur or IT professional. **PO9**
8. Postgraduates will develop confidence for self-education and ability for life-long learning. **PO10**

Scheme of Continuous Internal Evaluation (CIE):

Components	Phase-II	Phase-III	Total Marks
Maximum Marks: 50	50	50	50
	➢ **Submission and certification of project report is compulsory to qualify for SEE.** ➢ **a. 50 marks by Project phase 2 (Internal guide 25 marks + Dept presentation 25 marks).** **b. 50 marks by Project phase 3 (Internal guide 25 marks + Dept presentation 25 marks)** ➢ **Average of Phase-I and Phase-II will be considered as CIE Marks** ➢ **Minimum marks required to qualify for SEE : 25** ➢ **Internal guide has to evaluate the work progress of the student for the project work done and award the marks.** ➢ **Internal Guide has to submit the marks along with work progress report duly signed with seal, in sealed envelope to the department.** ➢ **Failing to meet the above process by candidate lead to disqualification of the project work-2 (15MCA63) course and eventually award of the degree.**		

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 jointly evaluate the project work-2.**

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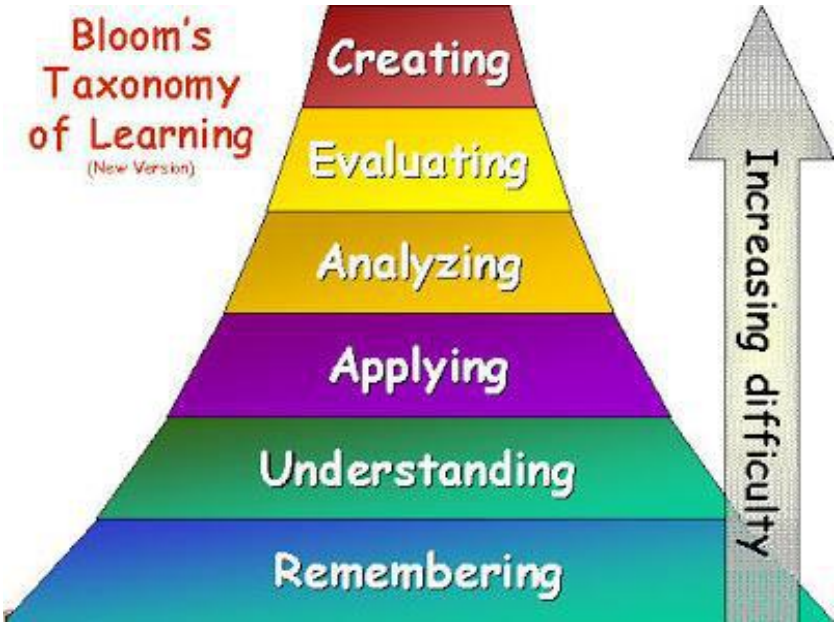
Bloom's Taxonomy of Learning Objectives

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.


Bloom's
Taxonomy
of Learning
(New Version)
Creating
Evaluating
Analyzing
Applying
Understanding
Remembering
Increasing difficulty

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