

# **Master in Computer Application ( MCA )**

## **STRUCTURE & SYLLABUS**

**( 2020 - 2021 )**



**P.G. Department of  
Information and Communication Technology  
Fakir Mohan University  
Vyasa Vihar, Balasore - 756019**

## Program Outcome

### **On completion of MCA degree, the graduates will be able to:**

- ✓ Apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement
- ✓ Design and develop applications to analyze and solve all computer science related problems
- ✓ Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects
- ✓ Analyze and review literatures to invoke the research skills to design, interpret and make inferences from the resulting data
- ✓ Integrate and apply efficiently the contemporary IT tools to all computer applications
- ✓ Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations
- ✓ Involve in perennial learning for a continued career development and progress as a computer professional
- ✓ Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills
- ✓ Communicate effectively and present technical information in oral and written reports
- ✓ Utilize the computing knowledge efficiently in projects with concern for societal, environmental, and cultural aspects
- ✓ Function competently as an individual and as a leader in multidisciplinary projects
- ✓ Create and design innovative methodologies to solve complex problems for the betterment of the society
- ✓ Apply the inherent skills with absolute focus to function as a successful entrepreneur.

# 25% of each paper will be in self study mode

**PG DEPARTMENT OF  
INFORMATION AND COMMUNICATION TECHNOLOGY  
FAKIR MOHAN UNIVERSITY**

**CURRICULUM FOR  
MASTER OF COMPUTER APPLICATION (MCA)  
(Applicable for 2020-2021 onwards)**

<b>First Semester</b>				
<b>Code</b>	<b>Subject</b>	<b>Lectures</b>	<b>Practical</b>	<b>Credits</b>
T101	Discrete Mathematics	4	0	4
T102	Programming and Problem Solving through C	4	0	4
T103	Computer Organization and Architecture	4	0	4
T104	Operating System	4	0	4
T105	Computer Networks	4	0	4
L106	Programming & Problem Solving (Lab)	0	4	4
L107	Operating Systems and Computer Architecture (Lab)	0	4	4
Total Credits				28

<b>Second Semester</b>				
<b>Code</b>	<b>Subject</b>	<b>Lectures</b>	<b>Practical</b>	<b>Credits</b>
T201	Data Structures	4	0	4
T202	Computer Graphics and Multimedia	4	0	4
T203	Probability and Statistics	4	0	4
T204	OOP using JAVA	4	0	4
T205	Design and Analysis of Algorithms	4	0	4
L206	Data Structures using JAVA Lab	0	4	4
L207	CG Lab	0	4	4
Total Credits				28

<b>Third Semester</b>				
<b>Code</b>	<b>Subject</b>	<b>Lectures</b>	<b>Practical</b>	<b>Credits</b>
T301	Database Management Systems	4	0	4

T302	Elective -I	4	0	4
T303	Web Technology	4	0	4
T304	AI and Machine Learning	4	0	4
T305	CBCS	4	0	4
L306	Web Technology Lab	0	4	4
L307	Database Management Systems Lab	0	4	4
Total Credits				28

<b>Forth Semester</b>				
<b>Code</b>	<b>Subject</b>	<b>Lectures</b>	<b>Practical</b>	<b>Credits</b>
T401	Data mining and SC	4	0	4
T402	Elective -II	4	0	4
T403	Compiler Design	4	0	4
T404	Software Engineering & UML	4	0	4
PL405	Technical Seminar	4	0	4
PL406	Major Project	0	0	8
Total Credits				28

<b>List of Electives</b>			
<b>Elective - I</b>		<b>Elective - II</b>	
<b>A</b>	Python Programming	<b>A</b>	Big Data
<b>B</b>	Wireless Sensor Network	<b>B</b>	Cryptography & Network Security
<b>C</b>	Mobile Computing	<b>C</b>	Object Oriented analysis and Design using UML
<b>D</b>	Theory of Automata	<b>D</b>	Digital Image Processing
<b>E</b>	E-Commerce & ERP	<b>E</b>	Cloud Computing
<b>F</b>	Embedded Systems	<b>F</b>	Internet of Things

**MCA**  
**1ST SEMESTER**  
**SYLLABUS**

<b>Code</b>	<b>Subject</b>	<b>Lecturers</b>	<b>Practical</b>	<b>Credits</b>
T101	Discrete Mathematics	4	0	4
T102	Programming and Problem Solving through C	4	0	4
T103	Computer Organization and Architecture	4	0	4
T104	Operating System	4	0	4
T104	Computer Networks	4	0	4
L106	Programming and Problem Solving Lab	0	4	4
L107	Operating System and Computer Architecture Lab	0	4	4
<b>Total Credits</b>				<b>28</b>

**DISCRETE MATHEMATICS****T101**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T101	Discrete Mathematics	4	20	80

<b>Objectives</b>	The objective of this course is to introduce students the ideas and techniques of elementary discrete mathematics that are widely used in science and engineering.
<b>Pre-Requisites</b>	Basic knowledge of sets and matrices is required.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT tools as and when required, sessions are planned to be interactive with focus on problem solving activities.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Propositional Calculus and Predicate Calculus, Rules of inference.	10
<b>II</b>	Proofs and proof strategies, Summation of sequences, Mathematical induction. Basics of counting techniques, Recurrence relation and its solutions, Principle of inclusion and exclusion and its applications.	12
<b>III</b>	Set Theory, Relation, Equivalence relation and Partial Order relation, Hasse-Diagram. Binary operation, semigroup, monoid, group and ring, group codes.	12
<b>IV</b>	Graphs, paths and connectivity in a graph, planar graph, Trees. Finite-state Machines with or without output, Equivalence of DFA & NFA, Regular Expressions	14
<b>Total</b>		48

**Text Books:**

- T1. K. H. Rosen, Discrete Mathematics and its Application, 7th Edition, McGraw-Hill, 2017.  
T2. C. L. Liu, Elements of Discrete Mathematics, 2nd Revised Edition, Tata McGraw-Hill, 1985.

**Reference Books:**

- R1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Indian Edition, McGraw-Hill Education, 2017.  
R2. T. Koshy, Discrete Mathematics and Applications, 1st Edition, Academic Press (Elsevier), 2003.  
R3. J. R. Mott, A. Kandel, and T. P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, 2nd Edition, Pearson Education India, 2015.

<b>Course Outcome</b>	At the end of the course, the students will be able to: i) Define & describe various logical connectives and expressions along with rules of inferences. ii) Construct various counting techniques using recurrence relations, generating functions for future applications. iii) Interpret the knowledge on sets, relations and functions. iv) Develop the concepts and applications of graphs. v) Identify & define algebraic structures like group, ring, Boolean algebra and its applications. vi) Develop the skill for learning compilers and interpreters.
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**PROGRAMMING AND PROBLEM SOLVING THROUGH 'C'**  
**T102**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T102	Programming and Problem Solving through 'C'	4	20	80

<b>Objectives</b>	i) To acquire problem solving skills ii) To be able to develop flowcharts iii) To understand structured programming concepts iv) To be able to understand the fundamentals of programming in C Language v) To be able to write programs in 'C' Language
<b>Pre-Requisites</b>	Formulate simple algorithms for arithmetic and logical problems. Translate the algorithms to programs (in C language) Test and execute the programs and correct syntax and logical errors. Implement conditional branching, iteration and recursion. Decompose a problem into functions and synthesize a complete program using divide and conquer approach Use arrays, pointers and structures to formulate algorithms and programs Apply programming to solve matrix problems and searching and sorting problems Apply programming to solve simple numerical method
<b>Teaching Scheme</b>	Theory - 4 Hours (Each week) Practical – 6 Hours (Each week) Total – 10 Hours (Each Week)

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators	12



	and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions	
<b>II</b>	<p>Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do While and Examples. Continue, Break and Goto statements</p> <p>Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.</p> <p>Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.</p> <p>Preprocessors: Preprocessor Commands</p>	12
<b>III</b>	<p>Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.</p> <p>Pointers–Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation.</p> <p>Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.</p>	12
<b>IV</b>	<p>Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self Referential Structures, Unions, Type Definition (typedef), Enumerated Types.</p> <p>Input and Output: Introduction to Files, Modes of Files, Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing onto a file.</p>	12
<b>Total</b>		48

**Text Books:**

- T1. B.A. Forouzan and R.F. Gilberg, "A Structured Programming Approach in C", Cengage Learning, 2007
- T2. Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006
- T3. Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006.

**Reference Books:**

- R1. Jeri Hanly and Elliot Koffman, "Problem Solving and Program Design in C", 6th edition Copyright 2011, ISBN: 0-321-53542-1 Publisher: Addison Wesley
- R2. Byron S Gottfried "Programming with C" Second edition, Tata McGrawhill, 2007 (Paper back)
- R3. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.
- R4. Kanetkar Y, "Let us C", BPB Publications, 2007.
- R5. Hanly J R & Koffman E.B, "Problem Solving and Program design in C", Pearson Education, 2009.
- R6. E. Balagurusamy, "Programming with ANSI-C", Fourth Edition, 2008, Tata McGraw Hill.
- R7. Venugopal K. R and Prasad S. R, "Mastering 'C'", Third Edition, 2008, Tata McGraw Hill.
- R8. ISRD Group, "Programming and Problem Solving Using C", Tata McGraw Hill, 2008.
- R9. Pradip Dey, Manas Ghosh, "Programming in C", Oxford University Press, 2007.

<b>Course Outcome</b>	<ul style="list-style-type: none"><li>i) After completion of this course the student is expected to analyze the problems.</li><li>ii) The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms, able to write, compile and debug programs in C.</li><li>iii) Use the various constructs of a programming language viz. conditional, iteration and recursion.</li><li>iv) Able to formulate problems and implement the algorithms in 'C' language.</li><li>v) Able to effectively choose programming components to solve computing problems in real-world.</li></ul>
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**COMPUTER ORGANIZATION & ARCHITECTURE**  
**T103**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T103	Computer Organization & Architecture	4	20	80

<b>Objectives</b>	This course is intended to teach the basics involved in data representation and digital logic circuits used in the computer system. This includes the general concepts in digital logic design, including logic elements, and their use in combinational and sequential logic circuit design. This course will also expose students to the basic architecture of processing, memory and i/o organization in a computer system.
<b>Pre-Requisites</b>	Prerequisite. Before learning the concepts of Computer Architecture and Organization, you should have a basic knowledge prior to Computer Architecture, basic functional units of a computer system, etc.
<b>Teaching Scheme</b>	<p>Teaching</p> <ul style="list-style-type: none"> <li>By providing lectures.</li> <li>By discussion case studies.</li> <li>By providing references for related white papers and articles.</li> <li>By motivating to participate in the competitions like presenting papers.</li> <li>Daily class room interaction.</li> </ul> <p>Assessment</p> <ul style="list-style-type: none"> <li>By regular and surprise class tests.</li> <li>By mid-term and semester exams.</li> <li>By quiz and colloquial.</li> </ul>

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Data representation and Logic circuits: Number System complements, fixed point representation, floating point representation, binary codes, error detection codes. Logic gates, Boolean algebra, maps simplification, combinational circuits, flip flops, sequential circuits. Digital components and RTL: integrated circuits, decoders, multiplexers, registers, shift registers, binary counters, memory unit. Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic	12

	shift unit.	
<b>II</b>	Basic Processing Unit: Instruction codes, Computer Registers, Computer instructions – Instruction cycle, Memory – Reference Instructions. Input – Output and Interrupt. STACK organization, Instruction formats, Addressing modes, DATA Transfer and manipulation, Program control, Reduced Instruction set computer.	12
<b>III</b>	Micro Programmed Control and Computer Arithmetic: Control memory, Address sequencing, micro program example, design of control unit, Hard-wired control. Micro programmed control unit Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.	12
<b>IV</b>	The Memory System and IOP: Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory. Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt, Direct memory Access.	12
	<b>Total</b>	48

**Text Books:**

T1. Computer System Architecture, Morris Mano, 3rd Edition.

T2. Computer organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.

**Reference Books:**

R1. Computer System Architecture, NaushJotwani- 7MM.

R2. Digital Electronics, James W Bignel, Robert Donovan, 5th Edition, Cengage Learning Publications.

R3. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

R4, Digital integrated electronics, Taub & Schilling, McGraw-Hill

R5. Digital Electronics, R P Jain, 4th Edition TMH.

<b>Course Outcome</b>	<p>The student will be able to:</p> <p>i) Identify, understand and apply different number systems and codes. Understand the digital representation of data in a computer system. Understand the general concepts in digital logic design, including logic elements, and their use in combinational and sequential logic circuit design.</p> <p>ii) Understand computer arithmetic formulate and solve problems, understand the performance requirements of systems.</p>
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**OPERATING SYSTEM  
T104**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T104	Operating System	4	20	80

<b>Objectives</b>	Operating systems are an essential part of any computer system and any computer-science education. This field is undergoing rapid change, as computers are now prevalent in virtually every application. The objective of this course is to have clear knowledge on basic concepts and algorithms of operating system.
<b>Pre-Requisites</b>	Basic knowledge of computer hardware and software
<b>Teaching Scheme</b>	Classroom teaching and use of power point presentations and demonstrations as and when required.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Operating System Introduction- Functions, Characteristics, Structures - Simple Batch, Multi programmed, timeshared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems. Operating-System services, System Calls. Process Management: Process concepts, Threads, operations on processes, process control block. Scheduling: Types of schedulers, process scheduling criteria, CPU scheduling algorithms.	12
<b>II</b>	Inter Process Communication & Synchronization: Mutual Exclusion, Semaphores, Classic Problems of Synchronization, Deadlocks: Reusable and Consumable Resources, Characterization of Deadlock, Prevention, Avoidance, Detection and Recovery from Deadlocks.	12
<b>III</b>	Memory Management: Basic Hardware, Logical Versus Physical Address Space, Address Binding, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory Management: Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.	12

<b>IV</b>	Storage Management: File concepts, access methods, directory structure, file system implementation, directory implementation, disk space management, disk structure and disk scheduling algorithms. I/O systems: I/O Hardware, polling, interrupt driven I/O, direct memory access.	12
<b>Total</b>		48

**Text Books:**

- T1. AviSilberschatz, Peter Baer Galvin, and Greg Gagne, Operating System Concepts, 8th Ed., Addition Wesley.
- T2. William Stallings: Operating Systems, PHI, Latest Edition.

**Reference Books:**

- R1. Milan Milenkovic, Operating Systems: Concept and Design, 3rd Ed., McGraw Hill Inc.
- R2. Andrew S. Tanenbaum, "Modern Operating Systems", PHI, latest edition.

<b>Course Outcome</b>	Apply algorithms and concepts in real life applications
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**COMPUTER NETWORKS**  
**T105**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T105	Computer Networks	4	20	80

<b>Objectives</b>	i) To understand the various components required to build different networks. ii) To learn about different types of networks, Networking models and services provided by various layers. iii) To learn the functions of different protocols.
<b>Pre-Requisites</b>	Concepts of Graph Theory, basics of data representation and signals
<b>Teaching Scheme</b>	ICT enabled regular classroom lectures with an emphasis on interactive learning.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Overview of Computer Networks: Effectiveness and components of data communication systems. Transmission modes: Simplex, half-duplex, Full-Duplex communications. Network Criteria, Types of connection: Point-to-point and multipoint line configuration, Network topologies: Bus, Ring, Tree, Star, Mesh, Hybrid, Categories of Networks: Local area, Wide area and Metropolitan area Networks. OSI and TCP/IP reference models.	12
<b>II</b>	Digital Transmission: Line coding Schemes, Parallel and serial transmission, Transmission media: Guided media (twisted pair, coaxial, Fiber-optic cable), Unguided media. Multiplexing: FDM, TDM, WDM, Error Detection and Correction: Types of errors, Error Detection, Block coding, Redundancy checks and checksum, Error correction methods: Single-bit error correction, Hamming code, Burst error correction.	12
<b>III</b>	Data link Control: Flow & Error control: Stop-and Wait ARQ, Sliding window ARQ. Data link protocols: Asynchronous and synchronous protocols, Character and bit oriented protocols, Local Area Networks: Traditional Ethernet, Fast Ethernet, IEEE802 standards, Token Bus, Token	12

	Ring, Fiber Distributed Data Interface (FDDI). Switching: Circuit switching. Packet switching, message switching.	
<b>IV</b>	Congestion control and Quality of Service: Traffic descriptor, traffic profiles, open-loop and closed-loop congestion control, techniques to improve QoS, Networking and Internetworking devices: Repeaters, Bridges, Routers, Gateways, Routing Algorithms. TCP/IP Protocols Suit: Overview, Network layer, Addressing, Subneting, Transport layer: UDP & TCP, Application layer: Client-server model, BOOTP, DHCP, Domain Name Space(DNS), Telnet, File Transfer Protocol (FTP), Simple Mail Transfer protocol (SMTP), Simple network management protocol (SNMP), HTTP.	12
	<b>Total</b>	48

**Text Books:**

- T1. AviSilberschatz, Peter Baer Galvin, and Greg Gagne, Operating System Concepts, 8th Ed., Addition Wesley.  
T2. William Stallings: Operating Systems, PHI, Latest Edition.

**Reference Books:**

- R1. Andrew S. Tanenbaum, "Computer Networks", Third Edition, Prentice-Hall India, 1996.  
R2. Alberto Leon-Garcia & Indra Widjaja, "Communication Networks- Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.  
R3. W. Stallings, "Data & Computer Communication", 5th Edition, Prentice Hall India, 1998.  
R4. S Keshav, "An Engineering Approach to Computer Networking", Addition Wesley, 1998.

<b>Course Outcome</b>	Students will be able to i) Describe the functions of each layer in OSI and TCP/IP model. ii) Explain the types of transmission media iii) Classify the routing protocols and analyze how to assign the IP addresses for the given network iv) Explain how to control congestion, improve service quality, switching and multiplexing techniques.
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**PROGRAMMING AND PROBLEM SOLVING LABORATORY**  
**L106**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L106	Programming and problem solving laboratory	4

**Detailed Syllabus**

Program in C to find the sum and average of the given numbers using for loop, while loop, and do-while loop.

Program in C to sum the series  $X^1+X^2+X^3+X^4+X^5+\dots+X^n$ .

Program in C to construct pyramid of digits.

Program in C to find average of n numbers using an array.

Program in C to print the sum of first 'n' even natural numbers.

Program in C to read a two-dimensional array and find the sum of the elements in the row-wise and column-wise separately and display the sums of the rows and columns.

Program in C to print the numbers and its cube from 1 to 10 using following control statements a) if-then-else b) for loop c) while loop d) do-while loop.

Program in C to read a two dimensional square matrix A and display its transpose.

Program in C that prints the factorial of given numbers using i) for loop ii) while loop iii) do...while loop.

Program to read data from the keyboard, write it to a file called INPUT, again read the same data from the INPUT file, and display it on the screen.

Program in C that print a given numbers whether it is prime or not using i) for loop ii) while loop iii) do...while loop.

Program in 'C' to read the students name and its average marks. If a student gets less than 40 then declare that he fails or else the passes. Prepare a computers list of give the list of names in alphabetical order separately for passed and failed students.

Program in C to display a name 27 times using the nested for loop.

Program to initialize the member of a structure and to display the contents of the structure on the screen.

Program in C to find the sum of given the two numbers using the global variable declaration.

A file named DATA contains a series of integer number. Code a program to read these numbers and then write all “odd” numbers to a file to be called ODD and all “even” numbers to a file to be called EVEN.

Program in C to display the number and its square from 0 to 10 using register variables.

Program to read a character from the keyboard and to display it on to the screen using the getchar (), getch (), putchar () and putch ().

Program in C to find the factorial of the given numbers using the recursive function.

Program in C to find Fibonacci sequence by recursion.

Program in C to find the sum of two nonnegative numbers recursively.

Program in C to find minimum and maximum of numbers using recursion.

Program in C to search for an element using binary search with recursion.

Program to declare a union as a pointer data type and display the contents of the union using pointer operator.

Program in C to find the sum of a given non-negative integers using a recursive function.

Sum = 1 + 2 + 3 + 4 + ..... n.

Program assigns some values to the members of a structure and to display a structure and to display the structure on the video screen using the structure tag.

Program in C to find the sum of given the two numbers using the global variable declaration.

Program to display the memory address of a variable using pointer before incrimination and after incrimination.

Program in C to find the largest and smallest element in a vector.

Program in C to find second largest and smallest element in a vector.

Program in C to delete duplicates in a vector.

Program in C to add two matrices.

Program in C to sort the elements of a vector in ascending order.

Program in C to insert an element into the vector.

Program in C to delete an element from the vector.

Program in C to find the smallest element in an array using pointers.

Program to read a character from the keyboard and to display it on to the screen using the getchar (), getch (), putchar () and putch ().

**OPERATING SYSTEM AND COMPUTER ARCHITECTURE LABORATORY**  
**L107**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L107	Operating system and computer architecture laboratory	4

**Detailed Syllabus**

**Operating System:**

Introduction to OS: DOS, Windows, and Linux/Unix- vi editor basics, common commands, Shell Programming

**Computer Architecture:**

Recognition of various components of Personal Computer (PC), dismantling and assembling a PC.

Some experiments using Hardware trainer kits for SMPS, CPU, Hard disk, Motherboard, printer, real time clock, etc.

Simulation of simple fundamental units like half adder, full adder, multiplexer, de-multiplexer, Arithmetic logic Unit, Simple processor (CPU) etc using VHDL code.

**MCA  
2ND SEMESTER  
SYLLABUS**

<b>Code</b>	<b>Subject</b>	<b>Lecturers</b>	<b>Practical</b>	<b>Credits</b>
T201	Data Structure	4	0	4
T202	Computer Graphics and Multimedia	4	0	4
T203	Probability and Statistics	4	0	4
T204	OOP Using JAVA	4	0	4
T204	Design and Analysis of Algorithms	4	0	4
L206	Data Structures using JAVA Lab	0	4	4
L207	Computer Graphics and Multimedia Lab	0	4	4
<b>Total Credits</b>				<b>28</b>

**DATA STRUCTURES**  
**T201**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T201	Data Structures	4	20	80

<b>Objectives</b>	<p>The objective of the course is to introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. After completion of this course student will be able to –</p> <p>Analyze step by step and develop algorithms to solve real world problems.</p> <p>Implementing various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs.</p> <p>Understanding various searching &amp; sorting techniques</p>
<b>Pre-Requisites</b>	<p>One programming language (C, C++, Java)-loop, array, stack, recursion.</p> <p>Math-proof by induction and contradiction.</p> <p>The Algorithmic Design and Techniques class.</p>
<b>Teaching Scheme</b>	<p>Theory - 4 Hours (Each week)</p> <p>Practical – 6 Hours (Each week)</p> <p>Total – 10 Hours (Each Week)</p>

**Detailed Syllabus**

Unit	Topics	Hours
<b>I</b>	<p>Basics: Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms- Average, best and worst-case analysis).</p> <p>Introduction to Data Structure: Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear &amp; Non Linear Data Structures</p>	12
<b>II</b>	<p>Linear Data Structure: Array: Representation of arrays, Applications of arrays, sparse matrix and its representation,</p> <p>Stack: Stack-Definitions &amp; Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi,</p>	12

	Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	
<b>III</b>	Nonlinear Data Structure: Tree: Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees- Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance. Graph: Matrix Representation Of Graphs, Elementary Graph operations (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning Graphs, paths and connectivity in a graph, planar graph, Trees. Finite: State Machines with or without output, Equivalence of DFA & NFA, Regular Expressions tree).	12
<b>IV</b>	Sorting and Searching: Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting On Several Keys, List and Table Sort, Linear Search, Binary Search. Hashing And File Structures: Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization.	12
<b>Total</b>		48

### **Text Books:**

- T1. Ellis Horowitz and SartajSahni, "Fundamentals of Data Structures in C", 2nd Ed, Universities Press, 2014
- T2. Seymour Lipschutz, "Data Structures Schaum's Outlines", Revised 1st Ed, McGraw Hill, 2014

### **Reference Books:**

- R1. Jean-Paul Tremblay & Paul G. Sorenson "An Introduction to Data Structures with Applications", 2nd Ed, Publisher-Tata McGraw Hill.
- R2. Reema Thareja, "Data Structures using C", 3rd Ed, Oxford press, 2012
- R3. A. M Ten Baum Publisher "Data Structures using C & C++" – Prentice-Hall International, 1989
- R4. Robert Kruse, Data Structures and Program Design in C", 2nd Ed, PHI, 1996
- R6. Sartaj Sahani "Fundamentals of Data Structures in C++"
- R5. Gilberg & Forouzan "Data Structures: A Pseudo-code approach with C" A Pseudo-code approach with C, 2nd Ed, Cengage Learning, Publisher-Thomson Learning, 2004.

<b>Course Outcome</b>	<p>On successful completion of the course, the student will:</p> <ul style="list-style-type: none"> <li>i) Be able to check the correctness of algorithms using inductive proofs and loop invariants.</li> <li>ii) Be able to compare functions using asymptotic analysis and describe the relative merits of worst-, average-, and best-case analysis.</li> <li>iii) Be able to solve recurrences using the master, the iteration, and the substitution method.</li> <li>iv) Become familiar with a variety of sorting algorithms and their performance characteristics (eg, running time, stability, space usage) and be able to choose the best one under a variety of requirements.</li> <li>v) Be able to understand and identify the performance characteristics of fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, polynomials and matrices, and graphs.</li> <li>vi) Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components and analyze them.</li> <li>vii) Be able to use the design techniques introduced i.e. dynamic programming, greedy algorithm etc. to design algorithms for more complex problems and analyze their performance.</li> <li>viii) Become familiar with the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.</li> </ul>
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**COMPUTER GRAPHICS AND MULTIMEDIA**  
**T202**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T202	Computer Graphics and Multimedia	4	20	80

<b>Objectives</b>	To understand i) How to scan convert the basic geometrical primitives. ii) Mapping from a world coordinate system to device coordinates system, clipping, and projections. iii) Two and three dimensional geometric transformations. iv) Parallel and perspective projections v) Technical aspect of Multimedia Systems.
<b>Pre-Requisites</b>	2D and 3D Geometry, Trigonometry
<b>Teaching Scheme</b>	ICT enabled regular classroom lectures with an emphasis to interactive learning and programming.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Applications of computer graphics, Elements of pictures created in computer graphics, Graphics display devices, Basic raster graphics algorithms for drawing 2D primitives: Characteristics of good line drawing algorithms, line drawing algorithms: Simple DDA, Symmetrical DDA, Bresenham's Line Drawing Algorithm. Circle drawing algorithms.	12
<b>II</b>	2D geometric transformations and 2D viewing: Basic transformations, Matrix representations and homogeneous coordinates, Composite transformations, Clipping and windowing: Need for clipping and windowing, Line clipping Algorithms: midpoint subdivision, Cohen-Sutherland, Cyrus-Beck, Liang-Barsky, polygon clipping Algorithms: Sutherland-Hodgeman, Weiler-Atherton, window-to-viewport coordinate transformation.	12
<b>III</b>	3D concepts & 3D object representations: Polygon surfaces, Curved lines and surfaces, Bezier & B-spline curves. 3D geometric transformations and	12



	3D viewing: Translation, Rotation, Scaling, Parallel & Perspective projections.	
<b>IV</b>	Introduction to Multimedia, Hardware elements, applications, data interface standards of Multimedia, Non Temporal Media: Text, Hypertext, Images. Multimedia Input/ output technologies, Digital Audio, Digital video, Wave Files, Music, MIDI , Multimedia Authoring, Compression and decompression structure: Lossless& Lossy compression, Huffman coding, arithmetic coding, LZW, JPEG.	12
<b>Total</b>		48

**Text Books:**

- T1. Donald Hearn & M. Pauline Baker, Computer Graphics C Version, Second Edition, Pearson Education.  
T2. Fred T. Hofstetter, Multimedia Literacy, Tata McGraw Hill, 1995.

**Reference Books:**

- R1. Roy A. Plastock & Zhigang Xiang, Schaum's Outline of Computer Graphics, Second Edition, Tata McGraw-Hill.  
R2. Ranjan Parekh, Principles of Multimedia, McGraw-Hill  
R3. James D. Foley, A. van Dam, Steven K. Feiner & John F. Hughes, Computer Graphics Principles & Practice, Second Edition in C, Pearson Education.

<b>Course Outcome</b>	Students will be able to implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
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**PROBABILITY AND STATISTICS**  
**T203**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T203	Probability and Statistics	4	20	80

<b>Objectives</b>	The objective of this course is to learn the basic concepts of probability and statistics including various methods of estimations & statistical testing useful for analysis of data.
<b>Pre-Requisites</b>	Basic knowledge of sets, coordinate geometry, and calculus is required.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT tools as and when required, sessions are planned to be interactive with focus on problem solving activities.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Basic Notions of Probability, Finite Sample Space, Conditional Probability and Independence, Bayes' Rule and its Applications, Random Variables. Discrete and Continuous probability distribution functions, Mean, Variance and Co-Variance of random variables.	12
<b>II</b>	Binomial distribution, Poisson distribution, Hyper-geometric distribution, Normal distribution, Uniform distribution, Joint distribution.	10
<b>III</b>	Fundamental Sampling Distributions and Data Description: Random sampling, Single sample – estimation of mean and variance, Two samples – estimating the difference between two means and ratio of two variances, Maximum likelihood estimation, Confidence interval.	12
<b>IV</b>	Hypothesis Testing: One and two tailed test, Single sample – test concerning single mean, two means, test of single and two proportions, Goodness of fit test. Simple Linear Regression and Correlation: Least square method, Correlation, Multiple linear regression, Analysis of variance.	14
<b>Total</b>		48

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**Text Books:**

T1. R. E. Walpole, R. H. Myers, S. L. Myers, and K. E. Ye, Probability & Statistics for Engineers & Scientists, 9th Edition, Pearson Education, 2012.

**Reference Books:**

R1. W. Mendenhall, R. J. Beaver, and B. M. Beaver, Probability and Statistics, 1st Edition, Cengage Learning, 2009.

R2. R. A. Johnson, I. Miller, and J. E. Freund, Probability and Statistics for Engineers, 9th Edition, Pearson Education, 2016.

<b>Course Outcome</b>	At the end of the course, the students will be able to: i) Solve problems on probability of discrete nature. ii) Solve problems on probability of continuous nature. iii) Infer on mean and variance of a data set. iv) Categorize the distribution type of a data set. v) Fit a curve using regression model.
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**OOP USING JAVA**  
**T204**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T204	OOP Using Java	4	20	80

<b>Objectives</b>	The objective of this course is to introduce the key concepts of object-oriented programming (OOP) using Java as the programming language.
<b>Pre-Requisites</b>	Basic analytical and logical understanding including basic knowledge and usage of computers is required for this course. Prior experience with a programming language will be beneficial.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Object oriented concepts: Object oriented systems development life cycle, Unified Modeling Language, UML class diagram, Use-case diagram; Java Overview: Java Virtual Machine, Java buzz words, Data types, Operators, Control statements, Class fundamentals, Objects, Methods, Constructors, Overloading, Access modifiers.	12
<b>II</b>	Inheritance: Basics of Inheritance, using super and final keyword, method overriding, Abstract classes, defining and importing packages, access protection, interfaces; Exception handling: Exception fundamentals, types, understanding different keywords (try, catch, finally, throw, throws), User defined exception handling.	12
<b>III</b>	Input/Output: Files, stream classes, reading console input; Threads: thread model, use of Thread class and Runnable interface, thread synchronization, multithreading, inter thread communication. String manipulation: Basics of String handling, String class, StringBuilder, StringBuffer, StringTokenizer. Applet basics and life cycle.	12
<b>IV</b>	Introduction to GUI Programming: working with windows, frames, graphics, color, and font. AWT Control fundamentals. Swing overview; JavaFX	12

	overview; Java database connectivity: JDBC overview, creating and executing queries, dynamic queries.	
<b>Total</b>		48

**Text Books:**

T1. H. Schildt, Java: The Complete Reference, 10th Edition, McGraw-Hill, 2017.

T2. Y. D. Liang, Introduction to Java Programming, 9th Edition, Pearson Education, 2012.

**Reference Books:**

R1. B. Bates, K. Sierra, Head First Java, 2nd Edition, O'Reilly Media, 2005.

R2. T. Budd, An Introduction to Object-Oriented Programming, 3rd Edition, Pearson

R3. I. Horton, Beginning Java, 7th Edition, Wrox Publications, 2011.

<b>Course Outcome</b>	Apply object oriented principles in software design process to develop Java programs for real life applications.
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**DESIGN AND ANALYSIS OF ALGORITHMS**  
**T205**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T205	Design and Analysis of Algorithms	4	20	80

<b>Objectives</b>	Algorithms lie at the heart of computing. Algorithms are key to write a good program. Hence, clear understanding of the concepts is essential.
<b>Pre-Requisites</b>	Basic knowledge of mathematics and computer application
<b>Teaching Scheme</b>	Classroom teaching, use of ICT tools and demonstrations as and when required.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Introduction: Introduction to Design and Analysis of Algorithm, Growth of Functions, Recurrences. Sorting and Selection: Insertion sort, Selection Sort, Sorting in Linear Time, Heapsort.	12
<b>II</b>	Introduction: Introduction to Design and Analysis of Algorithm, Growth of Functions, Recurrences. Sorting and Selection: Insertion sort, Selection Sort, Sorting in Linear Time, Heapsort.	12
<b>III</b>	Algorithm Design & Analysis Techniques (II): Dynamic Programming (Examples: Traveling Salesperson Problem), Greedy Method (Example: Activity-Selection Problem, Job Sequencing with Deadlines, Knapsack problem), Backtracking (Examples: 8-Queens Problem & Subset sum Problem).	12
<b>IV</b>	Graph Algorithms: Data Structure for Disjoint Sets, Minimal Spanning Tree (Algorithms Kruskal & Prim), Single Source Shortest Paths (Dijkstra's Algorithm), All Pairs of Shortest Paths (Floyd- Warshall Algorithm), String Matching Algorithms, Huffman Trees, NP-Completeness and Introduction to Approximation Algorithms.	12
<b>Total</b>		48

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**Text Books:**

- T1. T. H. Cormen, C. E. Leiserson & R. L. Rivest, Introduction to Algorithms, PHI, 3rd Edition.  
T2. E. Horwitz, S. Sahani, S. Rajasekharn, Fundamentals of Computer Algorithms, Galgotia Publication, latest edition.

**Reference Books:**

- R1. Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley Longmans, latest edition.  
R2. G. Brassard, P. Bratley, Fundamentals of Algorithmic, PHI, latest edition.

<b>Course Outcome</b>	Convert algorithms to programs and apply them to real life situations, analyzing time and space complexity of algorithms.
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**DATA STRUCTURES USING JAVA LABORATORY**  
**L206**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L206	Data Structures Using JAVA laboratory	4

**Detailed Syllabus**

Introduction, Compiling & executing a java program.  
Program with data types & variables.  
Program with decision control structures: if, nested if etc.  
Program with loop control structures: do, while, for etc.  
Program with classes and objects.  
Implementing data abstraction & data hiding.  
Implementing inheritance.  
Implementing and polymorphism.  
Implementing packages.  
Implementing generics.  
Program with modern features of java.  
Implementing interfaces and inner classes  
Implementing wrapper classes  
Implementing generics.  
Implementing cloning.  
Implementing Reflections  
Working with files.  
Implementing a Lexical Analyzer  
Implementing a parser  
Implementing a code generator



**COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY**  
**L207**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L207	Computer Graphics and Multimedia Laboratory	4

**Detailed Syllabus**

Introduction to OpenGL Programming.  
Implementing line drawing algorithms.  
Implementing circle drawing algorithms.  
Implementing ellipse drawing algorithms.  
Implementing Line Clipping Algorithms.  
Implementing Polygon Clipping Algorithms.  
Implementing 2-d Transformations.  
Implementing 3-d Transformations.  
Implementing scan fill, boundary fill algorithms.  
Implementing seed fill, flood fill algorithm.  
Writing program on B-Splines, Bezier Curves  
Writing program on Mandelbrot set & Julia set.  
Writing program on Sierpinski gasket, Koch curve.  
Writing program on Fractal trees & forest.  
Writing program on wire frame model & terrain generation.  
Implementing Ray tracing algorithm.  
Writing program on Animation & Morphing techniques.

**MCA**  
**3RD SEMESTER**  
**SYLLABUS**

<b>Code</b>	<b>Subject</b>	<b>Lecturers</b>	<b>Practical</b>	<b>Credits</b>
T301	Database Management System	4	0	4
T302	Elective-I	4	0	4
T303	Web Technology	4	0	4
T304	AI and Machine Learning	4	0	4
T304	CBCS	4	0	4
L306	Web Technology Lab	0	4	4
L307	Database Management System Lab	0	4	4
<b>Total Credits</b>				<b>28</b>

**ELECTIVE - I**

<b>Code</b>	<b>Subject</b>
A	Python Programming
B	Wireless Sensor Network
C	Mobile Computing
D	Theory of Automata
E	E-Commerce and ERP
F	Embedded Systems

## DATABASE MANAGEMENT SYSTEMS

### T301

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T301	Database Management Systems	4	20	80

<b>Objectives</b>	To study the fundamental concepts of database management system, like aspects of database design, database languages, and database-system implementation.
<b>Pre-Requisites</b>	Basic knowledge of data structures, computer organization, and programming.
<b>Teaching Scheme</b>	Classroom teaching, use of power point presentations, experimental work in laboratories, submission and evaluation of assignments.

### Detailed Syllabus

Unit	Topics	Hours
I	Database System Architecture–Introduction to Database Systems, Data Abstraction, Data Independence, Three Schema Architecture, Database administrator, Users, Database languages, Overall system structure. Data Models-Hierarchical, Network, Relational Model and Object Oriented Data models, Entity-Relationship (E-R) Model, E-R Diagram, keys, Reduction of E-R Diagram to tables.	12
II	Relational Query Languages: Relational algebra, extended operations, tuple and domain relational calculus basic operations, SQL – basic structure, set operations, aggregate functions, nested sub queries, Integrity Constraints. Relational Database Design: Functional dependencies, Armstrong’s axioms, decomposition, Normalization using Functional, Multi-valued, Join dependencies, Normal forms.	12
III	Query processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query optimization, Creation of complex values and objects. Transaction Processing: Transaction concept, Transaction state, Concurrent executions, Serializability.	12

<b>IV</b>	Concurrency Control and Recovery: Concurrency control, Locking and Time-stamp based schedules, Multi-version and Optimistic Concurrency control schemes, Recovery System, Deadlock handling. Database System Architectures: Centralized Systems, Client server systems, Parallel databases, Distributed databases, Data Mining and Warehousing concepts.	12
<b>Total</b>		48

**Text Books:**

- T1. Henry F. Korth and Abraham Silberschatz, S. Sudarshan, “Database System Concepts”, 6th edition, McGraw-Hill, 2012.  
T2. RamezElmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, 6th edition, Pearson Education.

**Reference Books:**

- R1. Bipin C. Desai, “An Introduction to Database Systems”, West Publications, 8th edition, 2006.  
R2. C. J. Date, “An introduction to Database Systems”, Addison Wesley Publications, latest edition.  
R3. Gary W. Hansen and James V. Hansen, “Database Management and Design”, Prentice Hall, latest edition.  
R4. Jeffrey A. Hoffer, Mary B. Prescott, Fred R. Mcfadden, Modern Database Management, Prentice Hall, 6th edition, 7th edition, 2002.  
R5. Ronald J. Norman, Object Oriented Systems Analysis and Design, Prentice Hall, latest edition.

<b>Course Outcome</b>	Create database and small projects using database languages.
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**PYTHON PROGRAMMING  
(ELECTIVE-I)  
T302 (A)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T302(A)	Python Programming	4	20	80

<b>Objectives</b>	To acquire programming skills, object Oriented Skills in Python and to develop the skill of designing Graphical user Interfaces in Python with the ability to write database applications in Python.
<b>Pre-Requisites</b>	Basic knowledge of programming and data structure.
<b>Teaching Scheme</b>	Blended learning with traditional and use of technology to emphasize on detailed implementation.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	History of Python, Need of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.	12
<b>II</b>	Lists- Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, and Comprehensions. Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.	12
<b>III</b>	Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User defined Exceptions.	12

<b>IV</b>	Brief Tour of the Standard Library, Multithreading, GUI Programming, Turtle Graphics, Testing: Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.	12
<b>Total</b>		48

**Text Books:**

T1. Python Programming: A Modern Approach, VamsiKurama, Pearson.

T2. Learning Python, Mark Lutz, Orielly.

T3. Think Python, Allen Downey, Green Tea Press.

**Reference Books:**

R1. Core Python Programming, W.Chun, Pearson.

R2. Introduction to Python, Kenneth A. Lambert, Cengage.

<b>Course Outcome</b>	Understand and comprehend the basics of python programming and Identify real-world applications using oops, files and exception handling provided by python.
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**WIRELESS SENSOR NETWORK  
(ELECTIVE-I)  
T302 (B)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T302(B)	Wireless Sensor Network	4	20	80

<b>Objectives</b>	To study about the fundamental concepts, design issues, solutions to the issues, architectures and protocols and the state-of-the-art research developments in sensor networks and ad hoc wireless networks.
<b>Pre-Requisites</b>	Basic knowledge of wireless ad-hoc networks and sensors.
<b>Teaching Scheme</b>	Power point presentations, demonstrations using videos, animations as per the requirements.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Routing Cellular and Ad hoc wireless networks; Issues of MAC layer and routing; Proactive, Reactive and Hybrid Routing protocols; Multicast Routing; Tree based and Mesh based protocols; Multicast with Quality of Service Provision Quality of Service: Real-time traffic support; Issues and challenges in providing QoS; Classification of QoS Solutions; MAC layer classifications; QoS Aware Routing Protocols; Ticket based and Predictive location based QoS Routing Protocols.	12
<b>II</b>	Energy Management Ad Hoc Networks: Need for Energy Management; Classification of Energy Management Schemes; Battery Management and Transmission Power Management Schemes; Network Layer and Data Link Layer Solutions; System power Management schemes.	12
<b>III</b>	Mesh Networks: Necessity for Mesh Networks; MAC enhancements; IEEE 802.11s Architecture; Opportunistic Routing; Self Configuration and Auto Configuration; Capacity Models; Fairness; Heterogeneous Mesh Networks; Vehicular Mesh Networks.	12

<b>IV</b>	Sensor Networks: Introduction to Sensor Network architecture; Data Dissemination; Data Gathering; MAC Protocols for sensor Networks; Location discovery; Quality of Sensor Networks; Evolving Standards.	12
<b>Total</b>		48

**Text Books:**

T1. Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks – Architectures and Protocols, C., Pearson Education, 2004.

**Reference Books:**

R1. Feng Zhao and Leonidas Guibas, Wireless Sensor Networks, Morgan Kaufman Publishers, 2004.

R2. C.K.Toh, Adhoc Mobile Wireless Networks, Pearson Education, 2002.

R3. Thomas Krag and Sebastin Buettrich , Wireless Mesh Networking , O’Reilly Publishers, 2007.

<b>Course Outcome</b>	Develop small projects on recent challenges in the field of sensor networks and wireless ad-hoc networks.
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**MOBILE COMPUTING  
(ELECTIVE-I)  
T302 (C)**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T302(C)	Mobile Computing	4	20	80

<b>Objectives</b>	To study about the fundamental concepts, design issues, solutions to the issues, architectures and protocols and the state-of-the-art research developments in Mobile Networks and Sensors.
<b>Pre-Requisites</b>	Basic knowledge of Mobile Networks and sensors.
<b>Teaching Scheme</b>	Power point presentations, demonstrations using videos, animations as per the requirements.

**Detailed Syllabus**

Unit	Topics	Hours
I	Introduction to Personal Communications Services (PCS): PCS Architecture, mobility management, Networks signaling, Global System for Mobile Communication (GSM) System overview: GSM Architecture, Mobility management, Network signaling.	12
II	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP. Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML), Wireless Local Loop (WLL) : Introduction to WLL Architecture, wireless Local Loop Technologies.	12
III	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000. Global Mobile Satellite Systems ; case studies of the IRIDIUM, ICO and GLOBALSTAR systems.	12

<b>IV</b>	Wireless Enterprise Networks : Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. Server-side programming in Java, Pervasive web application architecture, Device independent example application.	12
<b>Total</b>		48

**Text Books:**

- T1. Mobile Communication: J. Schiller, Pearson Education
- T2. Mobile Computing: P.K. Patra, S.K. Dash, Scitech Publications.
- T3. Mobile Computing: Talukder, TMH, 2nd Edition.

**Reference Books:**

- R1. Pervasive Computing: Burkhardt, Pearson Education.
- R2. Principles of Mobile Computing: Hansmann, Merk, Springer, 2nd Edition.
- R3. Wireless Communication & Networking: Garg, Elsevier
- R4. Third Generation Mobile Telecommunication Systems: P. Stavronlakis, Springer.
- R5. The Wireless Application Protocol: Sandeep Singhal, Pearson Education.

<b>Course Outcome</b>	Develop small projects on recent challenges in the field of sensor networks and Mobile Networks.
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**THEORY OF AUTOMATA  
(ELECTIVE-I)  
T302(D)**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T302(D)	Theory of Automata	4	20	80

<b>Objectives</b>	To learn i) Fundamentals of Regular and Context Free Grammars and Languages ii) The relation between Regular Language and Finite Automata, Contexts free Languages, PDA and TM. iii) How to design Automata's and machines as Acceptors, Verifiers and Translators. iv) How to design PDA as acceptor and TM as Calculators.
<b>Pre-Requisites</b>	Set theory
<b>Teaching Scheme</b>	ICT enabled regular classroom lectures with an emphasis to interactive learning and programming.

**Detailed Syllabus**

Unit	Topics	Hours
<b>I</b>	Fundamentals of automata theory, Strings, Alphabet, Language, Operations, Finite state machine, minimization of FSM, Moore and Mealy machines. Finite automaton model, DFA and NFA, NFA to DFA conversion, transition diagrams, Language recognizers.	12
<b>II</b>	Regular Languages & Grammars: Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma for regular sets, closure properties of regular sets. right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion.	12
<b>III</b>	Context free grammar, derivation trees & derivation of strings. Ambiguity in CFGs. Minimization of CFG. Chomsky normal form, Pumping Lemma for CFLs. Push Down Automata: definition, model, acceptance of CFL,	12

	Acceptance by final state and acceptance by empty state and their equivalence. Equivalence of CFL and PDA.	
<b>IV</b>	Turing Machine: definition, model, Representation of TMs, Types of TMs , Language acceptability by TMs, design of TM, Computable functions, recursively enumerable languages, Universal TMs, Halting problem, NP-Completeness.	12
<b>Total</b>		48

**Text Books:**

T1. Hopcroft H.E. and Ullman J. D. Pearson Education, Introduction to Automata Theory Languages and Computation, Pearson Education India.

**Reference Books:**

R1. K.L.P Mishra and N.ChandraSekaran ,Theory of computer Science, PHI, 2001.

R2. Lewis H.P. & Papadimition C.H. Pearson, Elements of Theory of Computation, PHI.

<b>Course Outcome</b>	<p>Students will able to:</p> <ul style="list-style-type: none"> <li>i) Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.</li> <li>ii) Understand, design, analyze and interpret Regular and Context Free languages, Expression and Grammars.</li> <li>iii) Design different types of Push down Automata as Simple Parser.</li> <li>iv) Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.</li> </ul>
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**E-COMMERCE & ERP  
(ELECTIVE-I)  
T302(E)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T302(E)	E-Commerce & ERP	4	20	80

<b>Objectives</b>	In this subject student will learn about the following points: i) Realize the concept of e-commerce & it's technology and infrastructure. ii) Identify the different transaction models in different group of e-commerce. iii) Relate the concept of usage of internet in day to day activities. iv) To understand and relate the security aspect in e commerce. v) Know the basic concept of ERP. vi) Create an idea for implementation of e commerce in an organization.
<b>Pre-Requisites</b>	Internet and Web Technology Cryptography and Network Security Mobile Computing
<b>Teaching Scheme</b>	Teaching By providing lectures. By discussion case studies. By providing references for related white papers and articles. By motivating to participate in the competitions like presenting papers. Daily class room interaction. Assessment By regular and surprise class tests. By mid-term and semester exams. By quiz and colloquial.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Overview of Electronic Commerce, Driving the Electronic Commerce Revolution, The Internet, Portals. Open Systems Inter Connection (OSI) Model, XML, Data Warehousing, Building own Website, Internet Security	12

<b>II</b>	E-Commerce and Internet, Electronic Market, Business to Business E-Commerce, Four C's (Convergence, Collaborative Computing, Content Management and Call Center), Wireless Application Protocol (WAP), Intranet and Extranets. Data Interchange (EDI), Electronic Payment Systems, E-Security.	12
<b>III</b>	Overview of enterprise systems – Evolution - Risks and benefits – Fundamental technology - Issues to consider in planning designing and implementation of cross functional integrated ERP systems. Small, medium and large enterprise vendor solutions, BPR, and best business practices. Business process Management and Functional modules.	12
<b>IV</b>	ERP IMPLEMENTATION: Planning Evaluation and selection of ERP systems, Implementation life cycle - ERP implementation, Methodology, Data Migration, Success and Failure factors of ERP Implementation. Extended ERP systems and ERP add-ons -CRM, SCM, Manufacturing prospective, Business analytics.	12
<b>Total</b>		48

**Text Books:**

T1. E-Commerce and Enterprise Resource Planning; CSV Murthy, HPH

**Reference Books:**

R1. E-Commerce, MM Oka, EPH

R2. Kalakotia, Whinston: Frontiers of Electronic Commerce, Pearson Education.

R3. Bhaskar Bharat: Electronic Commerce – Technologies & Applications, TMH

R4. Loshin Pete, Murphy P.A.: Electronic Commerce, Jaico Publishing Housing

R5. Enterprise Resource Planning- Concepts and Practices; V K Garg and N K Venkatkrishna, PHI

R6. Enterprise Resource Planning; AlexixLeon; TMH.

<b>Course Outcome</b>	<p>After completion of this course:</p> <ul style="list-style-type: none"> <li>i) Students will demonstrate knowledge on e-commerce and its application.</li> <li>ii) Students will be able to understand the concept to setup an ERP for e-business infrastructure.</li> <li>iii) Students will be able to evaluate a product for an organization for e-commerce and ERP.</li> <li>iv) Will understand the mechanism in e-commerce transaction.</li> <li>v) Students will develop a confidence for self-learning.</li> <li>vi) Students can participate and aware the society about the ERP, e-governance and its importance.</li> </ul>
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**EMBEDDED SYSTEMS  
(ELECTIVE-I)  
T302(F)**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T302(F)	Embedded Systems	4	20	80

<b>Objectives</b>	To introduce the technologies behind embedded computing systems. To introduce and discuss various software components involved in embedded system design and development. To expose students to the recent trends in embedded system design.
<b>Pre-Requisites</b>	Computer Organization, Microprocessors & Microcontrollers Basic electronics, digital electronics, knowledge of microcontrollers and C programming. Since you are from computer science background you would need a development board of any 8-bit microcontroller to get started.
<b>Teaching Scheme</b>	Theory - 4 Hours (Each week) Practical – 6 Hours (Each week) Total – 10 Hours (Each Week)

**Detailed Syllabus**

Unit	Topics	Hours
<b>I</b>	Introduction to Embedded Systems– Components of embedded system hardware–Software embedded into the system – Embedded Processors - CPU architecture of ARM processor (ARM9) – CPU Bus Organization and Protocol. Design and Development life cycle model - Embedded system design process – Challenges in Embedded system design.	12
<b>II</b>	Serial Communication Standards and Devices - UART, HDLC, SCI and SPI. Serial Bus Protocols - I2C Bus, CAN Bus and USB Bus. Parallel communication standards ISA, PCI and PCI-X Bus	12
<b>III</b>	Memory devices and systems - memory map – DMA - I/O Devices – Interrupts - ISR – Device drivers for handling ISR – Memory Device Drivers – Device Drivers for on-board bus. Programming concepts of Embedded programming – Features of	12

	Embedded C++ and Embedded Java (basics only). Software Implementation, Testing, Validation and debugging, system-on-chip. Design Examples: Mobile phones, ATM machine set-up-box.	
<b>IV</b>	Inter Process Communication and Synchronization -Process, tasks and threads –Shared data– Inter process communication - Signals – Semaphore – Message Queues – Mailboxes – Pipes – Sockets – Remote Procedure Calls (RPCs). Real time operating systems - Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization. Micro C/OS-II RTOS - System Level Functions – Task Service Functions – Memory Allocation Related Functions – Semaphore Related Functions. Study of other popular Real Time Operating Systems.	12
<b>Total</b>		48

### Text Books:

- T1. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
- T2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers - Elsevier 3ed, 2008

### Reference Books:

- R1. Frank Vahid and Tony Givargis, “Embedded Systems Design – A Unified Hardware / Software Introduction”, John Wiley, 2002
- R2. Iyer–“Embedded Real time System”s, 1e, McGraw Hill Education New Delhi, 2003
- R3. K.V. Shibu, “Introduction to Embedded Systems”, 2e, McGraw Hill Education India, 2016.
- R4. Lyla B. Das, “Embedded Systems: An Integrated Approach”, 1/e , Lyla B. Das, Embedded Systems, 2012
- R5. Rajkamal, “Embedded Systems Architecture, Programming and Design”, TMH, 2003
- R6. Steve Heath, “Embedded Systems Design”, Newnes – Elsevier 2ed, 2002.

<b>Course Outcome</b>	<p>The Student will be able to:</p> <ul style="list-style-type: none"> <li>i) Demonstrate the role of individual components involved in a typical embedded system</li> <li>ii) Analyze the characteristics of different computing elements and select the most appropriate one for an embedded system</li> <li>iii) Model the operation of a given embedded system iv. substantiate the role of different software modules in the development of an embedded system</li> <li>iv) Develop simple tasks to run on an (Real Time Operating System)RTOS</li> <li>v) Examine the latest trends prevalent in embedded system design</li> </ul>
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**WEB TECHNOLOGY**  
**T303**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T303	Web Technology	4	20	80

<b>Objectives</b>	The subject covers the wide range of web technologies both client side and server side to provide the exposure to the students to develop Rich Internet Applications.
<b>Pre-Requisites</b>	Basic knowledge of programming and internet applications.
<b>Teaching Scheme</b>	Power-point slides, Demonstration which include videos, animations, pictures, graphics for better understanding theory and practical work.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	The Internet and WWW: Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites ,HTML, Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML, HTML tags, color background, using images links, Lists, Tables and Forms CSS: External Style Sheets, Internal Style Sheets, Inline Style, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists.	12
<b>II</b>	JAVA Script Programming: JAVA Script, Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try.... Catch Statement, Throw Statement, and Objects of JavaScript: Date object, array object, Boolean object, math object.	12
<b>III</b>	PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing (Get and Post Method), Form Validation, Files, PHP server Variables, Dates and Times, Advance Features: Cookies and Sessions, Filters, Exception Handling.	12
<b>IV</b>	Data base connectivity using PHP : Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing	12

	database, listing table names, creating a table, inserting data, altering tables, queries, Setting query parameter, Executing query, Executing multiple queries, Deleting database, Deleting data and tables.	
	<b>Total</b>	48

**Text Books:**

- T1. Don Gosselin, et al., Web Warrior Guide to Web Design Technologies, Cengage  
T2. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill

**Reference Books:**

- R1. HTML 5, Black Book, dreamtech Press  
R2. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India  
R3. Web Technologies, Black Book, dreamtech Press.

<b>Course Outcome</b>	Develop the modern Web applications using the client and server side technologies and the web design fundamentals.
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## AI AND MACHINE LEARNING

### T304

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T304	AI and Machine Learning	4	20	80

<b>Objectives</b>	The basic objective of artificial intelligence and machine learning is to program computers to use example data or experience to solve a given problem. Additionally, this course is to introduce students the ideas and techniques of Artificial Intelligence and Machine Learning for developing a machine that can act and think like a rational being.
<b>Pre-Requisites</b>	Knowledge of basic probability, data structure, engineering optimization, and matrix theory.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT tools as and when required, sessions are planned to be interactive with focus on problem solving activities.

### Detailed Syllabus

Unit	Topics	Hours
<b>I</b>	Introduction to AI: Solving Problems by Searching-Uninformed Search (BFS, DFS, Uniform Cost Search, DLS, Iterative Deepening, Bidirectional), Informed (Heuristic) (Greedy Best First Search, Hill Climbing, Simulated Annealing, A*).	14
<b>II</b>	Constraint Satisfaction Problems, Forward and Backward Chaining, Knowledge Representation, and Bayesian Networks.	08
<b>III</b>	Learning and types of learning, Linear methods for Regression and Classification:-Linear regression models and least squares, Multiple Regression, Ridge Regression, LDA, Logistic regression, naïve Bayes Classifier.	12
<b>IV</b>	Dimensionality Reduction: Feature Extraction, feature Selection, PCA, ICA. Support vector machine (SVM), SVM for classification, SVM for regression, k-nearest neighbor classifiers, cluster analysis.	14
<b>Total</b>		48

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**Text Books:**

- T1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education India, 2015.
- T2. T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, 2nd Edition, Springer Verlag, 2009.
- T3. K. P. Murphy, Machine Learning: A Probabilistic Perspective, 4th Edition, MIT Press, 2012

**Reference Books:**

- R1. N. J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann, 2003.
- R2. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
- R3. T. Mitchel, Machine Learning, McGraw-Hill Science, 1997.
- R4. G. James, D. Witten, T. Hastie, and R. Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2013.
- R5. L. Wasserman, All of Statistics, 1st Edition, Springer, 2004.

<b>Course Outcome</b>	At the end of the course, the students will be able to: i) Explore different techniques to solve artificial intelligence problems by searching. ii) Explore the different techniques of knowledge representations and constraint satisfaction problems. iii) Understanding the principles of supervised and unsupervised learning.
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**FUNDAMENTALS OF INFORMATION AND COMMUNICATION  
TECHNOLOGY(CBCS)  
T305**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T305	Fundamentals of Information and Communication Technology(CBCS)	4	20	80

<b>Objectives</b>	The subject covers the wide range of Communication Technology and Fundamentals of Information Technology to provide the exposure to the students.
<b>Pre-Requisites</b>	Basic knowledge of Information and Communication Technology.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT tools as and when required, sessions are planned to be interactive with focus on Information and Communication Technology.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Data, Information, and Computer Organization: – Introduction, Types of Data, A Simple Model of a Computer, Data Processing Using a Computer. Data Storage: Introduction, Memory organization, Physical Devices used as Memory Cells, Random access Memory, Read only Memory, Secondary Memory, Compact Disk Read only Memory (CDROM), Flash Memory. Central Processing Unit: Introduction, The Structure of a Central Processing Unit, Interconnection of CPU with Memory and I/O Units.	12
<b>II</b>	Data Organization and Software: Data Organization: Introduction, Organizing a Database, Structure of a Database, Database Management System, Example of Database Design, Non-text Databases, Archiving Databases. Processing Numerical and Text Data: Introduction, Use of Spreadsheets, Numerical Computation Examples, Microsoft Word, Notepad, and Learning Power point Presentation. Software: Introduction, Operating System, Flowcharts, Algorithms, Programming Languages, Classification of Programming Languages.	12

<b>III</b>	Internet Technology: Computer Networks: Introduction, Local Area Network (LAN), Applications of LAN, Wide Area Network (WAN), Internet, Naming Computers Connected to Internet, The Future of Internet Technology. Some Internet Applications: Introduction, E-mail, Information Browsing Service, The World Wide Web, Information Retrieval from the World Wide Web, Other Facilities Provided by Browsers, Audio on the Internet, Pictures, Animation and Video via Internet	12
<b>IV</b>	Societal Impacts and Ethics of Information Technology: Introduction, Privacy, Security, and Integrity of Information, Disaster Recovery, Intellectual Property Rights, Careers in Information Technology and other relevant applications in business, science, Judicial System, Health Care System, and engineering.	12
<b>Total</b>		48

**Text Books:**

- T1. V. Rajaraman, Introduction to Information Technology, Prentice Hall of India, New Delhi.  
T2. P. K. Sinha and P. Sinha, Computer Fundamentals, BPB Publication.

**Reference Books:**

- R1. V. Rajaraman, Fundamentals of computers, Prentice Hall of India, New Delhi.  
R2. M. M. Mano, Computer System Architecture, Prentice Hall of India, New Delhi, 1995  
R3. Efraime Turban, R. Kelly Rainer, and Richard E. Potter, Introduction to Information Technology, Wiley.  
R4. Raj Kamal, Internet and Web Technology, Tata McGraw Hill Education.  
R5. J. P. Glaser and CloudiaSalzberg, The Strategic Application of Information Technology in Health Care Organization, Jossey- Bass.  
R6. R. Elmasri and S. B. Navathe, Fundamentals of Database System, Addison Wisley.

<b>Course Outcome</b>	At the end of the course, the students will be able to: i) Understand the Concept of Information and Communication Technology. ii) Understand the Concept of Hardware and Software of Computer Device. iii) Understand the Concept of Networking and Internet. iv) Understand the different applications of Information and Communication Technology in different fields.
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**WEB TECHNOLOGY LABORATORY**  
**L306**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L306	Web technology laboratory	4

**Detailed Syllabus**

**HTML & XML**

Write HTML code to use the tags like caption, title, body etc.

Write an HTML code to illustrate the usage of a. Ordered List    b. Unordered List

Write an HTML code to illustrate Nested and Definition tag.

Write an HTML code to illustrate Hyper Link tag (Anchor tag).

Write an HTML code to create a link At the bottom to take user to the top of the page

Write HTML code to Design a mark sheet and display all your marks with subjects in a tabular format.

Write an HTML code to display your education details in a tabular format.

Write an HTML code to show books in inventory in different tables by using rowspan and colspan.

Write an HTML code to display your CV on a web page.

Write HTML code for form and place some text boxes, command box, selection box etc on the form.

Write a small program using XML.

Write an XML program to display products

Develop an attractive Web site for an event to be organized in your institute.

**CSS**

Write an HTML code to demonstrate the usage of CSS.

Write an HTML code to demonstrate the usage of inline CSS.

Write an HTML code to demonstrate the usage of internal CSS.

Write an HTML code to demonstrate the usage of external CSS.

Write an HTML code to create a web page that displays college information using various Style sheets.

### **JavaScript**

Write a Java script to prompt for users name and display it on the screen.

Write a Java Script for displaying message, time and date etc using document write method.

Write a Java Script Script to extract month, year, day from current date.

Write a Java Script Script to extract hour, minute and seconds from current time.

Write a Java Script to calculate simple interest and compound interest using arithmetic operators.

Write programs to work with radio buttons and checkbox.

A web application that takes name and age from an HTML page. If the age is less than 18, it should send a page with "Hello , you are not authorized to visit this site" message, where should be replaced with the entered name. Otherwise it should send "Welcome to this site" message.

A simple calculator application that takes two numbers and an operator (+, -, \*, /, %) from an HTML page and returns the result page with the operation performed on the operands.

After applying all (CSS, Java Script and HTML form submitting tags on the pages, design a 6 pages website.

Login page

Home page

About Us page

Contact us page

News Page

Site view

Design an XML document to store information about a student in an degree college affiliated to FMU. The information must include Regd. No, Name, and Name of the College, Stream, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

### **PHP**

Write a program using PHP and HTML to create a form and display the details entered by the user.

Write PHP code to display date and time.

Write a PHP program named states.php that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". Write a PHP program that does the following:

Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.

Search for a word in states that begins with k and ends in s. Perform a case in sensitive



comparison. [Note: Passing re. Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList.

Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.

Search for a word in states that ends in a. Store this word in element 3 of the list

### **PHP with MySQL**

Write an HTML program to design an entry form of student details and send it to store at database server

Write a program to establish the connection with the database and populating values in the combo box.

Write a program to display all the records in the table.

Write a program to insert the record into the table.

Write a program to display a registration form.

Write a program to store the data in the table.

Write PHP code to create a form through which data can be uploaded into automated system.

Write PHP code to create a cookie.

Write PHP code to create a table and insert records into it.

Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

A user validation web application, where the user submits the login name and password to the server. The name and password are checked against the data already available in Database and if the data matches, a successful login page is returned. Otherwise a failure message is shown to the user.

A web application takes a name as input and on submit it shows a hellopage where is taken from the request. It shows the start time at the right top corner of the page and provides the logout button. On clicking this button, it should show a logout page with Thank You message with the duration of usage (Use session to store name and time).

**DATABASE MANAGEMENT SYSTEMS LABORATORY**  
**L307**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>
L307	Database Management Systems laboratory	4

**Detailed Syllabus**

Creating, Altering, Dropping tables with Constraints, Insert Table.

Experiment 1: Create Tables

Experiment 2: Alter table with changes in columns

Experiment 3: Alter table with constraints

Experiment 4: Dropping Tables

Experiment 5: Inserting Data into Tables.

Inserting, Simple Select, Char, Number, Date functions

Experiment 6: Simple Select

Experiment 7: Select with conditions.

Experiment 8: Using character functions.

Experiment 9: Using number functions.

Experiment 10: Using date functions.

Detailed SELECT with sub-queries, EQUI-JOINS, correlated sub-queries.

Experiment 11: Single row sub-queries.

Experiment 12: Multiple row sub-queries.

Experiment 13: Equal joins.

Experiment 14: correlated sub-queries.

GROUPING, SET, UPDATE, DELETE, VIEWS

Experiment 15: Aggregate functions.

Experiment 16: Grouping clauses

**MCA  
4TH SEMESTER  
SYLLABUS**

<b>Code</b>	<b>Subject</b>	<b>Lecturers</b>	<b>Practical</b>	<b>Credits</b>
T401	Data Mining and Soft Computing	4	0	4
T402	Elective-II	4	0	4
T403	Compiler Design	4	0	4
T404	Software Engineering and UML	4	0	4
T404	Technical Seminar	4	0	4
T406	Major Project	0	0	8
<b>Total Credits</b>				<b>28</b>

**ELECTIVE - II**

<b>Code</b>	<b>Subject</b>
A	Big Data
B	Cryptography and Network Security
C	Object Oriented Analysis and Design using UML
D	Digital Image Processing
E	Cloud Computing
F	Internet of Things

**DATA MINING AND SOFT COMPUTING****T401**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T401	Data Mining and Soft Computing	4	20	80

<b>Objectives</b>	The basic objective of this course is to introduce students the ideas and techniques of soft computing for solving the tasks of different data mining to uncover hidden knowledge from vast amount of data.
<b>Pre-Requisites</b>	Knowledge of data analysis, optimization, and matrix theory.
<b>Teaching Scheme</b>	Regular classroom lectures with use of ICT tools as and when required, sessions are planned to be interactive with focus on problem solving activities.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Knowledge discovery in Databases, Data Mining Processes, Data mining Tasks-Association Rule Mining, Classification, Clustering, Regression, Change Detection. Data Mining Software-WEKA, KEEL, Classical Algorithms of Data Mining different tasks.	14
<b>II</b>	Fuzzy Set Theory: fuzzy sets, basic definition and terminology, Set-Theoretic operations, Membership Function Formulation and Parameterization, T-norm, T-conorm; Fuzzy Rules and Fuzzy Reasoning: Extension Principle and Fuzzy Relations, Fuzzy if-then rules, Fuzzy reasoning; Fuzzy Inference Systems: Mamdani Fuzzy models, Sugeno Fuzzy models, Tsukamoto Fuzzy models.	10
<b>III</b>	Neural Networks: Model of a neuron, LMS, Perceptron, MLP and Back propagation algorithm, Radial Basis Function Networks, Functional Link Artificial Neural Networks, Self- Organizing Maps.	12
<b>IV</b>	Nature Inspired Computing: Simulated Annealing, Genetic Algorithm, Differential Evolution, Ant & Bee Algorithm, Particle Swarm Optimization.	12

	Multi-Objective Optimization: Pareto Optimality, Weighted Sum Method, Metaheuristic Approaches, VEGA, NSGA-II.	
	<b>Total</b>	48

**Text Books:**

- T1. J. Han, M. Kamber, and J. Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann Series.
- T2. J. S. R. Jang, C.-T, Sun, and E. Mizutani, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, 1st Edition, Pearson Education, 2015.
- T3. S. Haykin, Neural Networks: A Comprehensive Foundation, 2nd Edition, Pearson Education.
- T4. X. -S. Yang, Nature-Inspired Optimization Algorithms, 1st Edition, Elsevier Publication, 2014.
- T5. K. Deb, Multi-objective Optimization Using Evolutionary Algorithms, John Wiley & Sons Ltd., 2002.

**Reference Books:**

- R1. M. Panda, S. Dehuri, and M. R. Patra, Modern Approaches of Data Mining-theory and Practice, Narosa, 2016.
- R2. Simon Haykin, Neural Networks A Comprehensive Foundation, Pearson Education.
- R3. H.J. Zimmermann, Fuzzy Set Theory and its Applications, AlliedPublishers Ltd., Kluwer Academic Publishers.
- R5. A.P. Engelbrecht, Computational Intelligence An Introduction, John Wiley & Sons Ltd.

<b>Course Outcome</b>	At the end of the course, the students will be able to: i) Explore different tasks of data mining. ii) Explore the different techniques of soft computing. iii) Differentiate between supervised and unsupervised learning.
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**BIG DATA  
(ELECTIVE – II)  
T402(A)**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T402(A)	Big Data	4	20	80

<b>Objectives</b>	<ul style="list-style-type: none"> <li>i) Understand the Big Data Platform and its Use cases</li> <li>ii) Provide an overview of Apache Hadoop</li> <li>iii) Provide HDFS Concepts and Interfacing with HDFS</li> <li>iv) Understand Map Reduce Jobs</li> <li>v) Provide hands on Hadoop Eco System</li> <li>vi) Apply analytics on Structured, Unstructured Data.</li> <li>vii) Exposure to Data Analytics with R</li> </ul>
<b>Pre-Requisites</b>	Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.
<b>Teaching Scheme</b>	Theory -4 Hours (Each week) Practical – 6 Hours (Each week) Total – 10 Hours (Each Week)

**Detailed Syllabus**

Unit	Topics	Hours
<b>I</b>	Introduction To Big Data Introduction to Big Data, Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications	12
<b>II</b>	Hadoop and HDFS(Hadoop Distributed File System) Introduction to Hadoop(T1): Introduction, Hadoop and its Ecosystem tools, History of Hadoop, Apache Hadoop,Analysing Data with Hadoop, Hadoop Streaming. Hadoop Distributed File System Basics (T2): The Design of HDFS, HDFS Concepts, Design features, Components, Command Line Interface, Hadoop file system interfaces, HDFS User Commands, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression,	12

	Serialization, Avro and File-Based Data structures.	
<b>III</b>	<p>Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.</p> <p>Hadoop Eco System</p> <p>Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.</p> <p>Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.</p> <p>Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction</p>	12
<b>IV</b>	<p>Machine Learning Algorithms for Big Data Analytics</p> <p>Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR. Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics</p>	12
	<b>Total</b>	48

**Text Books:**

- T1. Raj Kamal and PreetiSaxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, ISBN: 9789353164966, 9353164966, 2018
- T2. Douglas Eadline, “Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem”, 1stEdition, Pearson Education, ISBN-13: 978-9332570351, 2016.

**Reference Books:**

- R1. Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.
- R2. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
- R3. Anil Maheshwari, “Data Analytics”, 1 st Edition, McGraw Hill Education, ISBN-13: 978-9352604180, 2017.
- R4. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
- R5. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press, 2013.
- R6. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media, 2013.
- R7. AnandRajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

<b>Course Outcome</b>	The students will be able to: i) Identify Big Data and its Business Implications. ii) List the components of Hadoop and Hadoop Eco-System iii) Access and Process Data on Distributed File System iv) Manage Job Execution in Hadoop Environment v) Develop Big Data Solutions using Hadoop Eco System vi) Analyze Infosphere BigInsights Big Data Recommendations. vii) Apply Machine Learning Techniques using R.
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**CRYPTOGRAPHY AND NETWORK SECURITY**  
**(ELECTIVE – II)**  
**T402(B)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T402(B)	Cryptography and Network Security	4	20	80

<b>Objectives</b>	To understand i) Cryptography Theories, Algorithms and Systems. ii) Necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
<b>Pre-Requisites</b>	Computer Networks and Operating Systems
<b>Teaching Scheme</b>	ICT enabled regular classroom lectures with an emphasis to interactive learning and programming.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Need for Security , Security Policies, Model of network security , Security attacks, services and mechanisms, OSI security architecture, Cryptography: Concepts and Techniques, Introduction, Plain & Cipher text, Classical encryption techniques: substitution techniques, transposition techniques, Symmetric and asymmetric key Cryptography, Steganography.	12
<b>II</b>	SYMMETRIC KEY CIPHERS: Block cipher design principles, Block cipher mode of operation, The Data Encryption Standard (DES), Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principle, International data encryption algorithm (IDEA). Advanced Encryption Standard: Origins, Structure, Round Functions, Key Expansion, AES Implementation. RC4.Diffie-Hellman Key exchange algorithm.	12
<b>III</b>	Asymmetric Key Algorithms: Brief history, overview, The RSA Algorithm. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards,	12

	Knapsack algorithm. Digital certificates, Private Key Management, public key cryptography standards.	
<b>IV</b>	IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload. Web Security: requirements, secure sockets layer and Transport layer security, Secure Electronic Transaction, Electronic Mail Security. System security: Intrusion Detection, Password Management, Malicious Software: Types of Malicious Software, Viruses, Worms, Denial of Service Attacks, Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls.	12
	<b>Total</b>	48

**Text Books:**

T1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson Education.

**Reference Books:**

R1. AtulKahate, Cryptography and Network Security, 2nd Edition, TMH

R2. Eric Maiwald, Fundamentals of Network Security, Dreamtech press.

R3. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security – Private Communication in a Public World, Pearson/PHI.

R4. Robert Bragg, Mark Rhodes, Network Security: The complete reference, TMH.

<b>Course Outcome</b>	Students will be able to i) Describe the concept of Cryptography and its various Implementation in different field. ii) Explain the types of Malicious and Non-Malicious Software iii) Explain the need of Security Mechanism and policies in different field of Networking. iv) Explain different types of Asymmetric Algorithms that are used in the Network Security System.
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**OBJECT ORIENTED ANALYSIS AND DESIGN USING UML  
(ELECTIVE – II)  
T402(C)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T402(C)	Object Oriented analysis and Design using UML	4	20	80

<b>Objectives</b>	In this subject student will learn about the following points: i) To develop background knowledge as well as core expertise in object-oriented system. ii) To analyze and design problems using UML. iii) To deliver the importance of software design process. iv) To be able to explain and justify designs based on design principles and patterns.
<b>Pre-Requisites</b>	Object Oriented Programming Algorithm Analysis and Design Principles of Programming Languages.
<b>Teaching Scheme</b>	Teaching By providing lectures. By discussion case studies. By providing references for related white papers and articles. By motivating to participate in the competitions like presenting papers. Daily class room interaction. Assessment By regular and surprise class tests. By mid-term and semester exams. By quiz and colloquial.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
I	Introduction to Object Technology: Complexity, The Object Model, Classes and Objects, Classification. OOAD Methods - Object Oriented Design by Booch, Rumbaugh's Object Modeling Technique, Coad/Yourdon's Object-Oriented Analysis, Shlaer/ Mellor's Object-Oriented Structured Analysis (OOSA) / Object Oriented Design Language	12

	(OODLE), Object Oriented Software Engineering (OOSE) by Jacobson. Importance of Modeling, Principles of modeling.	
<b>II</b>	UML & Class: Overview of UML, Building blocks of UML. Analysis and design, Object oriented analysis and design, Classes, Relationships, class diagrams. Advanced classes, Advance Relationships, Interfaces, types and roles, Packages, Instances, Object diagrams.	12
<b>III</b>	Interactions, Use cases, Use case diagrams, Interaction diagrams, activity diagrams, Process and threads, Time and space, State chart diagram.	12
<b>IV</b>	Components, Component diagrams, Deployment and Deployment diagram, Collaboration and Collaboration diagram. Case studies using UML diagram.	12
<b>Total</b>		48

**Text Books:**

- T1. Grady Booch, "Object-Oriented Analysis & Design with Applications", 3rd Edition, Pearson.  
T2. J.Rumbaugh and Michael R. Blaha, "Object Oriented Modelling and Design", PHI  
T3. E Gamma, R Helm, R Johnson and J Vlissides, — Design Patterns- Elements of Reusable Object-Oriented Software, Pearson.

**Reference Books:**

- R1. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design with the Unified Process, Course Technology Inc.  
R2. Craig Larman, Applying UML and Patterns – An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3rd Edition, Pearson Education.  
R3. Jim Arlow, Ila Neustadt, UML 2 and the Unified Process – Practical Object-Oriented Analysis and Design, Pearson Education.  
R4. Timothy C. Lethbridge, Robert Laganere, Object Oriented Software Engineering, Tata McGrawHill.

<b>Course Outcome</b>	After completion of this course: <ul style="list-style-type: none"> <li>i) Understand the different facets of object-oriented methodologies.</li> <li>ii) Gain an understanding of how design patterns facilitate software design.</li> <li>iii) Understand Object Oriented Software Development Process.</li> <li>iv) Apply object-oriented methods for analysis and design of real-world problems.</li> <li>v) Apply the concepts of UML to design real world problems.</li> </ul>
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**DIGITAL IMAGE PROCESSING  
(ELECTIVE – II)  
T402(D)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T402(D)	Digital Image Processing	4	20	80

<b>Objectives</b>	The course aims to cover techniques and tools for digital image processing, image transformation in spatial and frequency domains.
<b>Pre-Requisites</b>	Basic knowledge of Computer Graphics and Programming
<b>Teaching Scheme</b>	Blended teaching and learning with traditional and use of technology to emphasize on detailed implementation.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Introduction: Digital image representation, Fundamental steps in image processing, Components of Digital Image processing systems, Elements of visual perception, Image Formation model, Image Sampling and quantization, Relationship between pixels – neighbourhood, adjacency connectivity, regions, boundaries and distance measures.	12
<b>II</b>	Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering- Smoothing Spatial filters, Sharpening Spatial filters, Frequency domain- Fourier Transform, Low-Pass, HighPass, Laplacian, Homomorphic filtering.	12
<b>III</b>	Image Segmentation: Detection of discontinuities - point, line and edge detection, Edge linking and boundary detection, Thresholding, Regionbased segmentation - region growing, region splitting and merging, Color Image Processing: Color Models, Pseudo color Image Processing, Color Transformations, Smoothing and sharpening, Image Segmentation based on color.	12

<b>IV</b>	Image Compression: Coding redundancy, Interpixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Lossless predictive coding, Lossy compression, Image compression standards, Real-Time image transmission, JPEG and MPEG.	12
<b>Total</b>		48

**Text Books:**

T1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", Addison-Wesley,

T2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall

**Reference Books:**

R1. Digital Image Processing – Mehena, Adhikary and Routray; Alok Publications, Bhubaneswar.

<b>Course Outcome</b>	The course also aims to cover techniques and tools for digital image processing, and to provide hands-on experience in applying these tools to process images.
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**CLOUD COMPUTING  
(ELECTIVE – II)  
T402(E)**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T402(E)	Cloud Computing	4	20	80

<b>Objectives</b>	i) To impart the fundamentals of virtualization techniques. ii) To introduce concepts and security issues of cloud paradigm. iii) To introduce cloud computing-based programming techniques and cloud services.
<b>Pre-Requisites</b>	Having basic knowledge of operating systems like Windows OS, Linux etc. As Visualization play a major role in AWS you need to have the understanding of it. Networking is an essential skill as all operations on cloud platform involves it. Understanding the difference between the Public and Private cloud.
<b>Teaching Scheme</b>	Theory: 4 Hours each week Practical: 6 Hours each week Total: 10 Hours each week

**Detailed Syllabus**

Unit	Topics	Hours
I	INTRODUCTION TO VIRTUALIZATION Overview of Centralized, Distributed Computing -Cluster computing, Grid computing. Technologies for Network based systems - Virtual Machines and Virtualization Middleware – Data Center Virtualization for Cloud Computing – Implementation Levels of Virtualization – Virtualization Structures/Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices.	12
II	INTRODUCTION TO CLOUD COMPUTING System Models for Distributed and Cloud Computing – Software Environments for Distributed Systems and Clouds – Cloud Computing and Service Models – Public – Private – Hybrid Clouds – Infrastructure-as-a-Service (IaaS) – Platform-as-a-Service (PaaS) - Software-as-a-Service (SaaS)-Different Service Providers	12
III	CLOUD ARCHITECTURE AND RESOURCE MANAGEMENT Architectural Design of Compute and Storage Clouds – Public Cloud Platforms: – Amazon Web Services(AWS) – AzureEmerging Cloud	12

	Software Environments– Open Stack – Extended Cloud Computing Services – Resource Provisioning and Platform Deployment – Virtual Machine Creation and Management. CLOUD PROGRAMMING Parallel Computing and Programming Paradigms – Map Reduce – Twister – Iterative Map Reduce – Current technologies – Emerging Cloud software Environment.	
<b>IV</b>	SECURITY IN THE CLOUD Security Overview – Cloud Security Challenges – Security -as-a Service – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security. USING CLOUD SERVICES : Email Communications – Collaborating on To-Do Lists –Contact Lists – Cloud Computing for the Community- Collaborating on Calendars – Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management	12
	<b>Total</b>	48

**Text Books:**

- T1. Kai Hwang , Geoffrey C Fox, Jack J Dongarra : “Distributed and Cloud Computing – From Parallel Processing to the Internet of Things” , Morgan Kaufmann Publishers – 2012  
T2. RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi“Mastering Cloud Computing”  
McGraw Hill Education

**Reference Books:**

- R1. Alex Amies, Harm Sluiman, QiangGuo Tong and Guo Ning Liu: “Developing and Hosting Applications on the cloud”, IBM Press, 2012.  
R2. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)”, O’Reilly Publications, 2009.  
R3. Haley Beard, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing – applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008  
R4. James E. Smith and Ravi Nair: Virtual: Machines: Versatile Platforms for Systems and Processes, Morgan Kaufmann, ELSEVIER Publication, 2006.  
R5. John W Rittinghouse and James F Ransome , “Cloud Computing: Implementation – Management – and Security”, CRC Press, 2010.  
R6. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, Pearson Education, 2009.  
R7. Richard N. Katz, “The Tower and The Cloud”, Higher Education in the Age of Cloud Computing, 2008.  
R8. Toby Velte, Anthony Velte and Robert Elsenpeter: “Cloud Computing – A Practical Approach”, TMH, 2009.



<b>Course Outcome</b>	The Student will be able to: i) Identify the significance of implementing virtualization techniques. ii) Interpret the various cloud computing models and services iii) Compare the various public cloud platforms and software environments. iv) Apply appropriate cloud programming methods to solve big data problems. v) Appreciate the need of security mechanisms in cloud vi) Illustrate the use of various cloud services available online.
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**INTERNET OF THINGS  
(ELECTIVE – II)  
T402(F)**

<b>Subject Code</b>	<b>Subject Name</b>	<b>Credit</b>	<b>Int. Marks</b>	<b>Ext. Marks</b>
T402(F)	Internet of Things	4	20	80

<b>Objectives</b>	The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.
<b>Pre-Requisites</b>	Basic knowledge of programming and data structure.
<b>Teaching Scheme</b>	Blended learning with traditional and use of technology to emphasize on detailed implementation.

**Detailed Syllabus**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.	12
<b>II</b>	Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.	12
<b>III</b>	Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.	12
<b>IV</b>	IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.	12
<b>Total</b>		<b>48</b>

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**Text Books:**

- T1. Vijay Madiseti, ArshdeepBahga, İnternet of Things, “A Hands on Approach”, University Press
- T2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, “Introduction to İnternet of Things: A practical Approach”, ETI Labs.

**Reference Books:**

- R1. Pethuru Raj and Anupama C. Raman, “The İnternet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
- R2. Jeeva Jose, “İnternet of Things”, Khanna Publishing House, Delhi.
- R3. Adrian McEwen, “Designing the İnternet of Things”, Wiley.
- R4. Raj Kamal, “İnternet of Things: Architecture and Design”, McGraw Hill.
- R5. CunoPfister, “Getting Started with the İnternet of Things”, O Reilly Media.

<b>Course Outcome</b>	The Student will be able to: i) Understand IoT and its hardware and software components ii) Interface I/O devices, sensors & communication modules iii) Remotely monitor data and control devices iv) Develop real life IoT based projects
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## COMPILER DESIGN

### T403

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T403	Compiler Design	4	20	80

<b>Objectives</b>	To understand more deeply how a compiler translates the program into machine language. To become more skilled at writing effective code, debugging it when things go wrong.
<b>Pre-Requisites</b>	Basic knowledge of automata, programming and translators.
<b>Teaching Scheme</b>	Classroom teaching, use of ICT tools and demonstrations as and when required.

### Detailed Syllabus

Unit	Topics	Hours
I	Introduction to Compiling and Lexical Analysis: Compilers, Analysis of the source program, the phases of a compiler, Cousins of the compiler, the grouping of phases, Compiler-construction tools. Lexical Analysis -The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language for specifying lexical analyzers, Design of a lexical analyzer generator.	12
II	Syntax Analysis: The role of the parser, Context-free grammar, writing a grammar, Top- down parsing, Bottom-up parsing, Operator-precedence parsing, LR parsers, Parser generators. Syntax-Directed Translation: Syntax-directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Top-down translations, Bottom-up evaluation of inherited attributes.	12
III	Run-Time Environments: Source language issues, Storage organization, Storage allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques. Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions, Case statements.	12

<b>IV</b>	Code Generation: Issues in the design of a code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, Next- use information, A simple code generator, Register allocation and assignment, The Dag representation of basic blocks. Code Optimization: Introduction, The principle source of optimization, Optimization of basic blocks, Loops in flow graphs.	12
<b>Total</b>		48

**Text Books:**

T1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, “Compilers - Principles, Techniques and Tools”, Addison Wesley.

T2. John E. Hopcraft & Jeffrey D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Narosa Publishing House, New Delhi.

**Reference Books:**

R1. Lex and Yacc by Johan R. levine, Tonny Mason, et. al. O’ Reilly and Associates.

R2. “Compilers Design in C” Allen I. Holub, PHI eastern economy edition 2003.

<b>Course Outcome</b>	Write a parser for a given language, create tools for debugging and translating
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## SOFTWARE ENGINEERING AND UML

**T404**

Subject Code	Subject Name	Credit	Int. Marks	Ext. Marks
T404	Software Engineering and UML	4	20	80

<b>Objectives</b>	<ul style="list-style-type: none"><li>i) Develop methods and procedures for software development that can scale up for large system.</li><li>ii) Demonstrate the procedure of converting a valid software design into efficient code.</li><li>iii) Systematic approach to develop software within specified time and budget to produce high quality product.</li><li>iv) Focus on project management and software risk management.</li></ul>
<b>Pre-Requisites</b>	<p>Learn an oop language: Java, C++, Python etc. choose one and try to master it.</p> <p>Algorithm and data structure: These are most important field of computer science. Being good at Algorithm and data structure is always a plus point. Knowing how to implement a particular solution in the most efficient way is key for a software developer working out problems alongside on platforms.</p> <p>Choose a platform: Android, windows, web etc. choose one and work towards building you knowledge accordingly get to know the platform in and out.</p>
<b>Teaching Scheme</b>	<p>Teaching</p> <ul style="list-style-type: none"><li>By providing lectures.</li><li>By discussion case studies.</li><li>By providing references for related white papers and articles.</li><li>By motivating to participate in the competitions like presenting papers.</li><li>Daily class room interaction.</li></ul> <p>Assessment</p> <ul style="list-style-type: none"><li>By regular and surprise class tests.</li><li>By mid-term and semester exams.</li><li>By quiz and colloquial.</li></ul>

## Detailed Syllabus

Unit	Topics	Hours
<b>I</b>	Software Engineering: Definition. Phases in Software Engineering. Software Characteristics, Classification of Software. Software Process, Software Life Cycle Models Selection Criteria of Software Process Models. Software Requirement: Types of Requirements, Feasibility Study, Types of Feasibility. Requirements Analysis Structured Analysis Requirements Specification, purpose of SRS, characteristics of SRS, structure of SRS.	12
<b>II</b>	Software Design: Data Design, Architectural Design, Component-level Design, Cohesion & Coupling, User Interface Design, Coding Guidelines, Coding & Testing: Coding Methodology, Code Verification Techniques, Coding Tools. Software Testing Strategies, V Model of Software Testing, Levels of Software Testing, Testing Techniques, Software Testing Tools, Debugging.	12
<b>III</b>	Software Maintenance: Types of Software Maintenance, Software Maintenance Life Cycle, Software Maintenance Models, Techniques for Maintenance, Tools for Software Maintenance Planning & Scheduling: Project Planning Process Scheduling Project Staffing People Capability Maturity Model Risk Management Quality concepts: Software Quality Assurance Activities, Evaluation of Quality, Capability maturity model, Software Reliability.	12
<b>IV</b>	Cost Estimation: Software Cost Estimation Process, Decomposition Techniques, Software Estimation Models. Basics of Software Configuration Management. UML Fundamentals: Principles of UML, Concepts of UML diagrams with simple examples.	12
<b>Total</b>		48

**Text Books:**

- T1. Roger S. Pressman, Software Engineering, A practitioner's Approach, 6th edition. McGrawHill International Edition.
- T2. Rajib Mall, Fundamental of Software Engineering, Prentice Hall of India.

**Reference Books:**

- R1. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers
- R2. Waman S Jawadekar, Software Engineering Principles and Practice, McGraw-Hill Companies.
- R3. Ian Sommerville, Software Engineering, 9th edition, Addition Wesley.

<b>Course Outcome</b>	After learning the course the students should be able to: i) Prepare SRS document and software project management plan documents. ii) Apply the concept of functional oriented and objective oriented approach for software design. iii) Recognise how to ensure the quality of software products different quality standards and software review techniques. iv) Apply various testing techniques and test plan in. v) Able to understand modern Agile development.
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