		L	T	P	C
118PPT05	**PROBLEM SOLVING AND PYTHON PROGRAMMING**	3	0	0	3

COURSE OBJECTIVE(S):

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures — lists, tuples, dictionaries.
6. To do input/output with files in Python.

Prerequisite: Nil

UNIT I ALGORITHMIC PROBLEM SOLVING   9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS   9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS   9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES   9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES   9

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages; Illustrative programs: word count, copy file.

TOTAL: 45 hrs.

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COURSE OUTCOMES:

Upon completion of the course, students will be able to

1. Develop algorithmic solutions to simple computational problems
2. Read, write, execute by hand simple Python programs.
3. Structure simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised andupdated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. John V Guttag, —Introduction to Computation and Programming Using Python'', Revisedand expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A. Budd, —Exploring Python , Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs , CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: AnIntroduction to Computer Science using Python 3 , Second edition, Pragmatic Programmers, LLC, 2013.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop algorithmic solutions to simple computational problems	3			3	3										
CO2	Read, write, execute by hand simple Python programs	3		1		3		3			3					
CO3	Structure simple Python programs for solving problems	3		1						2	3					
CO4	Decompose a Python program into functions.	3	2			3			2	2	1					
CO5	Represent compound data using Python lists, tuples, dictionaries.	3			3	1				2						

COURSE OBJECTIVE(S):

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

LIST OF PROGRAMS:

1. To Implement python scripts using Variables and operators
2. To Demonstrate Operator precedence to evaluate an expression
3. Display grade of a student using elif statement
4. Implement Floyd triangle using for loop
5. Checks the given number is prime or not using while loop
6. Compute the GCD of Numbers using functions
7. Finding factorial of a given number using recursive function.
8. Takes a list of words and returns the length of longest one using strings
9. To perform linear and binary search using strings
10. To implement list as arrays (multiply 2 matrices)
11. To demonstrate use of list & related functions
12. To demonstrate use of tuple, set& related functions
13. To demonstrate use of Dictionary& related functions
14. Finding most frequent words in a text read from a file
15. Programs that take command line arguments (word count)

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.

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Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Identify the different components of a web page that can be used for mining	3			3	3										
CO2	Apply machine learning concepts to web content mining	3		1	3		3			3						
CO3	Design a system to collect information available on the web to build Recommendersystems	3		1					2	3						
CO4	Analyze social media data using appropriate data/web mining techniques	3	2		3			2	2		1					
CO5	Build a simple search engine using available open source tools	3			3	1			2							

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| 318CIT02 | DIGITAL ELECTRONICS | L T P C |
| | | 3 0 0 3 |

COURSE OBJECTIVE(S):

At the end of the course ,the students should be able to:

- Introduce basic postulates of Boolean algebra and shows the correlation betweenBoolean expressions
- Outline the formal procedures for the analysis and design of combinational circuitsand sequential circuits
- Discuss the concept of memories and programmable logic devices.
- Illustrate the concept of synchronous and asynchronous sequential circuits.
- Interpolate the concept of Programming inVHDL.

Prerequisites: Nil

UNIT – I   BOOLEAN ALGEBRA AND LOGIC GATES   9

Review of binary number systems - Binary arithmetic – Binary codes – Boolean algebra and theorems - Boolean functions – Simplifications of Boolean functions using Karnaugh map and tabulation methods –Logic gates.

UNIT – II   COMBINATIONAL LOGIC   9

Combinational circuits – Analysis and design procedures - Circuits for arithmetic operations – Codeconversion -Decoders and encoders - Multiplexers and demultiplexers–Comparator.

UNIT – III   SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL LOGIC   9

Sequential circuits – Flip flops – Analysis and design procedures - State reduction and state assignment - Shift registers – Counters Analysis and design of asynchronous sequential circuits - Reduction of state and flow tables – Hazards-Hazard free realizations.

UNIT – IV   PROGRAMMABLE LOGIC DEVICES, MEMORY ANDLOGIC FAMILIES   9

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, Introduction to Flash Memory. Digital LogicFamilies: TTL, ECL, CMOS.

UNIT – V   PROGRAMMING WITH VHDL   9

VHDL program structure-operators-Data flow modeling-Design of combinational and sequential circuits- examples:Adders,subtractors,multiplexers/Demultiplexers,Encoder/Decoder,FF's,Counters).

COURSE OUTCOMES:

Upon Completion of this course, students will be able to :

Co1: Solve the Postulates of Boolean algebra using different techniques

Co2: Design the Combinational and sequential circuits

Co3: Apply the concept of synchronous and asynchronous circuit

Co4: Summarize the concept of memories and programmable logic devices.Knowledge in VHDL for VLSI Design

TEXT BOOK (S) :

M.Morris Mano, "Digital Design", 3rd edition, Pearson Education, 2007.

REFERENCE(S) :

1. Charles H.Roth, Jr. "Fundamentals of Logic Design", 4th Edition, Jaico Publishing House, Latest Edition.

2. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, 2007

3. Charles H.Roth,Lizy Kurian John,"Digital System Design using VHDL"2nd edition PWS PublishingCompany,2008

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Solve the Postulates of Boolean algebra using different techniques	3		1	3	2	3	1	1		1				1	
CO2 Design the Combinational and sequential circuits	3			3	2	3	1	1		1				1	
CO3 Apply the concept of synchronous and asynchronous circuit	3		1	3	2	3	1	1		1				1	
CO4 Summarize the concept of memories and programmable logic devices.Knowledge in VHDL for VLSI Design	3	2		3	2	3	1	1		1				1	

318CST03   DATABASE MANAGEMENT SYSTEM

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3 0 0 3

OBJECTIVE(S):

- Learn the fundamentals of data models and conceptualize and depict a database system using ER diagram.
- Make a study of SQL and relational database design.
- Know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To know the internal storage structures, indexing and advanced database concepts.

Prerequisites: Nil

UNIT-I   INTRODUCTION   7

Purpose of Database System – Views of data - Database Languages – Data Models – Database System Architecture – Database users and Administrator – Entity Relationship model (E-R Model) – E-R Diagrams.

UNIT-II   RELATIONAL MODEL   9

The relational Model – The catalog - Types of Keys - Relational Algebra – Domain Relational Calculus –Tuple Relational Calculus - SQL fundamentals – Additional Basic Operations – **Set Operations –Join Operations - Aggregate Functions – Nested Sub Queries** - Integrity – Triggers - Security & Authorization – Embedded SQL– Dynamic SQL - Views.

UNIT-III   DATABASE DESIGN   9

Functional Dependencies – Non-loss Decomposition– First, Second, Third Normal Forms & Dependency Preservation – Boyce / Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT-IV   TRANSACTION MANAGEMENT   9

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Two Phase Commit – Save Points – Concurrency Control – Locking Based Protocols – Deadlock Handling – **Timestamp Based Protocols** - Serializability – **Transaction as SQL statements.**

UNIT-V   STORAGE STRUCTURES   11

Overview of Physical Storage Media – Tertiary storage – RAID - File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B tree - B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Measures of query cost – Database Tuning - OODB & XML Databases – **Introduction to Distributed Databases.**

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Gain and design extensive knowledge on various data models and ER diagram.

CO2: Recognize and develop sophisticated queries and authorization techniques to extract information from database

CO3: Analyze and eliminate all kind of dependency in a database schema via normalization techniques.

CO4: Apply concurrency control and recovery mechanism.

CO5: Understand the internal storage structures using different file and indexing techniques& advanced database concepts

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Tata McGraw Hill, 2019.
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, "Database Systems", 6th Edition, Pearson, 2014.
2. Raghu Ramakrishnan, J.Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
3. Shio Kumar Singh, "Database Systems Concepts, Design and Applications", 2nd Edition, Pearson, 2011.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Gain and design extensive knowledge on various data models and ER diagram.	3				2		3	3							
CO2 Recognize and develop sophisticated queries and authorization techniques to extract information from database	3		1		2		3	2							
CO3 Analyze and eliminate all kind of dependency in a database schema via normalization techniques.	3			3			3	2						3	
CO4 Apply concurrency control and recovery mechanism.	3	2		3		2	3								2
CO5 Understand the internal storage structures using different file and indexing techniques & advanced database concepts	3				2		3	2							

OBJECTIVES:

- Demonstrate a thorough understanding of the object-oriented programming paradigms.
- Build C++ classes using appropriate encapsulation and design principles.
- Learn to use several oops concepts to create, debug and run simple C++ programs.
- To impart hands on experience to solve different problems using C++.

PREREQUISITE: Programming in C

UNIT-I INTRODUCTION 9

Object-Oriented Paradigm - Merits and Demerits of OO Methodology – Object-Oriented Programming Concepts: Classes – Objects – Data abstraction and encapsulation – Inheritance – Polymorphism – Dynamic binding – Message Passing – C++ Fundamentals: Tokens – Expressions – Control Structures - Functions.

UNIT-II CLASSES AND OBJECTS 9

Classes and Objects – Passing objects as arguments – returning objects – Friend functions – Inline function – Static data and member functions - Constructors - Parameterized constructor – Copy constructor – Destructor - Array of Objects – pointer to object members.

UNIT-III POLYMORPHISM AND INHERITANCE 9

Polymorphism – Function overloading – Unary operator overloading – binary operator overloading – Data Conversion - Overloading with Friend Functions. Inheritance – Constructor in Derived class – Abstract Classes - Types of Inheritance.

UNIT-IV VIRTUAL FUNCTIONS, TEMPLATES AND STANDARD TEMPLATE LIBRARY 9

Virtual functions – Need - Pure Virtual Functions – Virtual Destructors. Template – Class template, Function Template. **STL: Introduction algorithms – Sequence Containers – Iterators – Specialized Iterators – Associative Containers – Strong user-defined object – Function objects.**

UNIT-V FILES AND EXCEPTION HANDLING 9

C++ streams – console streams – console stream classes - formatted and unformatted console I/O operations – Manipulators. File streams classes - File modes - File pointers and Manipulations - File I/O – Exception handling - Exception handling Model – List of Exceptions – catch all Exception –uncaughtExceptions – **User Defined Exceptions.**

TOTAL : 45 Hours

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Describe the important concepts of Object Oriented Programming.

CO2: Identify the relationship between the classes and link them using appropriate concepts.

CO3: Develop solutions for given problems using Polymorphism and Inheritance concepts to solve real world problems.

CO4: Devise generic classes capable of manipulating primitive and user defined data types.

CO5: Develop and implement File I/O operations and Exception handling mechanisms.

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TEXT BOOK:

1. Robert Lafore, "Object Oriented programming in C++", 4th Edition, Techmedia Publication,2013.

REFERENCE BOOKS:

1. Bjarne Stroustrup, "The C++ programming language", Addison Wesley, fourth edition, 2013.
2. K R Venugopal, Rajkumar Buyya, "Mastering C++", 2nd Edition, McGraw Hill Education (India)Pvt. Ltd., 2013.
3. Herbert Schildt, "The Complete Reference,C++"4th Edition, 2011.
4. Paul J Deitel, Harvey M Deitel: "C++ for Programmers", Pearson Education, 2009.
5. Stanley B.Lippmann, Josee Lajoie: "C++ Primer", 4th Edition, Addison Wesley, 2012.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Describe the important concepts of Object Oriented Programming	3				3		2	2							
CO2 Identify the relationship between the classes and link them using appropriate concepts	3		1		3		2	2							3
CO3 Develop solutions for given problems using Polymorphism and Inheritance concepts tosolve real world problems.	3				3		2	2							
CO4 Devise generic classes capable of manipulating primitive and user defined data types.	3	2			3		2	2							
CO5 Develop and implement File I/O operations and Exception handling mechanisms.	3		1		3		2	2							2

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318CIT05 DATA STRUCTURES	3	0	0	3

OBJECTIVES
- Understand the need and fundamental concepts of List ADT.
- Acquire knowledge in Stack and Queue data structures.
- Explore Comprehensive knowledge of Trees and their implementations.
- Learn graph data structure to solve problems.
- Familiar with Sorting, Searching and Hashing algorithms.

PREREQUISITES: Programming in C

UNIT I   LINEAR DATA STRUCTURES – LIST   6

Abstract Data Types - The List ADT - Array based Implementation - Linked list Implementation - Doubly Linked List - Circular Linked List - Applications of Linked List - Polynomial Operations

UNIT II   LINEAR DATA STRUCTURES – STACKS AND QUEUES   9

The Stack ADT - Array Implementation - Linked List Implementation - Applications of Stack - Balancing Symbols - Postfix Expressions - Infix to Postfix Conversion - The Queue ADT - Array Implementation - Linked List Implementation - Circular Queue - Application of Queues.

UNIT III   NON LINEAR DATA STRUCTURES – TREES   10

Preliminaries - Binary Trees - Array Implementation - Linked List Implementation - Tree Traversals - Expression Trees - Binary Search Tree - Operations on Binary Search Tree – AVL Trees - Heaps - Binary Heaps - Operations of Heaps -Binomial Queues - B-Tree -B$^+$ Trees.

UNIT IV   NON LINEAR DATA STRUCTURES -GRAPHS   10

Representation of Graphs –BreadthFirst Traversal- Depth First Traversal - **Bi-connectivity – Cut vertex – Euler circuits–** Topological Sorting– Application of Graphs - Shortest Path Algorithm: Floyd Warshall - Bellman Ford - Dijkstra'sAlgorithm -Minimum Spanning Trees: Prim's Algorithm - Kruskal's Algorithm.

UNITV   SEARCHING, SORTING AND HASH TECHNIQUES   10

Searching: Linear Search - Binary Search. **Sorting :** Insertion Sort - Selection Sort - Shell Sort - Bubble Sort - Quick Sort - Merge Sort - Radix Sort. **Hashing:** Hash Functions - Separate Chaining -Open Addressing - Rehashing - Extendible Hashing.

Total Hours: 45

COURSE OUTCOMES:
At the end of the course the students will be able to

CO1: Implement List ADT to solve real time problems.
CO2: Develop applications using Stack and Queues data structures.
CO3: Design and Implement applications on trees.
CO4: Implement graph data structure for solving problems.
CO5: Develop various Sorting, Searching and Hashing algorithms to small and large data sets.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2016.
2. Debasis Samanta, "CLASSIC DATA STRUCTURES", Second Edition, PHI LearningPrivate Limited Publishers, 2011

REFERENCES:

1. Michael T. Goodrich ,Roberto Tamassia , David Mount , "Data Structures and Algorithms in C++", Second Edition, 2016.

2. Wisnu Anggoro ,"C++ Data Structures and Algorithms: Learn how to write efficient codeto build scalable and robust applications in C++", 2018

3. Ellis Horowitz, Sartaj Sahani,Dinesh Mehta, "Fundamentals of Data Structures in C++",Second Edition,2008

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Implement List ADT to solve real time problems.	3			3	3		2								3
CO2 Develop applications using Stack and Queues data structures	3			3	3		2							3	
CO3 Design and Implement applications on trees	3		1	3	3	1	2								3
CO4 Implement graph data structure for solving problems.	3			3	2	2	1								3
CO5 Develop various Sorting, Searching and Hashing algorithms to small and large data sets.	3	2		3	2	2	1								3

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318CIT06   COMPUTER ORGANIZATION

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OBJECTIVES:

- To have insight into the basic structure of computers.
- To understand the design and implementation of ALU.
- To comprehend the importance of the memory and I/O communication.
- To familiarize basic concepts of Parallelism.

PREREQUISITES: NIL

UNIT-I   BASIC STRUCTURE OF COMPUTER SYSTEM   9

Functional units – Basic operational concepts – Bus structures – Memory Locations and Addresses – Instructions and instruction sequencing - Addressing modes –RISC and CISC - Basic I / O Operations.

UNIT-II   COMPUTER ARITHMETIC AND CONTROL UNIT   9

Number Representation and Arithmetic Operations - Addition and Subtraction of Signed Numbers – Multiplication of Positive Numbers – Signed Operand Multiplication– Integer Division - Floating point Numbers and operations - Control Units - Fundamental concepts – Instruction Execution– Hardwired control – Micro programmed control.

UNIT-III   PIPELINING   9

Basic concepts – Data hazards – Instruction hazards - Unconditional branches – Conditional branches –Branch Prediction – Influence on instruction sets – Data path and control considerations - Super scalar operations – Performance considerations.

UNIT-IV   MEMORY & I/O ORGANIZATION   9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – **Performance Considerations of Cache memory - Virtual memory** - Accessing I/O devices – Interrupts – Direct Memory Access – Interface circuits – Standard I/O Interfaces: USB, **Firewire**.

UNIT-V   PARALLELISM   9

ILP – Concepts & Challenges – Compiler Techniques – Reducing branch costs – Dynamic scheduling - Parallel Processing and Performance- Hardware Multithreading – Flynn's Classification (SISD, MIMD, SIMD, SPMD) - Vector (SIMD) Processing - Shared-Memory Multiprocessors -Cache Coherence - Message-Passing Multi computers - Parallel Programming for Multiprocessors - Performance Modeling.   **Total Hours: 45**

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COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Understand basic operational concepts of computers, ALU and Instructions.
CO2: Know the computer arithmetic and control unit operations.
CO3: Comprehend and analyze the Pipelined Execution.
CO4: Know the various Memory Systems and I/O Organization.
CO5: Understand Parallelism and Multiprocessor architectures.

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky&NaraigManjikian-"Computer Organizationand Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

2. John L. Hennessey and David A. Patterson, - "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Sixth Edition, 2017.

REFERENCE BOOKS:

1. David A. Patterson and John L. Hennessy, -"Computer Organization and Design: The Hardware / Software interface", Fourth Edition, Elsevier, 2012.

2. William Stallings, - "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand basic operational concepts of computers, ALU and Instructions	3				2	3		2								2
CO2	Know the computer arithmetic and control unit operations.	3				2	3		2								2
CO3	Comprehend and analyze the Pipelined Execution.	3		1		2	3		2								2
CO4	Know the various Memory Systems and I/O Organization.	3				2	3		2								2
CO5	Understand Parallelism and Multiprocessor architectures	3	2			2	3		2								2

Course Objective(s):
   At the end of the course ,the students should be able to:

- Identify the various functions of digital IC's.
- Demonstrate the various combinational circuits using logic gates.
- Design and Implement various sequential circuits using logic gates
- Develop VHDL code for various combinational
- Generate VHDL code for various sequential circuits.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of Adder/Subtractor, Encoders/Decoders,Code Converters usingbasic gates.
3. Design and implementation of 4-bit binary adder / subtractor using MSI Circuits.
4. Design and implementation of parity generator / checker using basic gates and MSI Circuits
5. Design and implementation of Magnitude Comparator
6. Design and implementation of Multiplexers/Demultiplexers
7. Design and implementation of Shift registers
8. Design and implementation of Synchronous and Asynchronous counters

VHDL PROGRAMMING

9. Simulation of Adder/Subtractor.
10. Simulation of Encoders/Decoders.
11. Simulation of Shift Registers.
12. Simulation of Counters.

Course Outcomes
   Upon Completion of this course, students will be able to :

- Apply Digital ICs for various applications.
- Analyze the various combinational circuits using logic gates.
- Implement various sequential circuits using logic gates
- Write VHDL code for various combinational circuits
- Write VHDL code for various sequential circuits

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Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply Digital ICs for various applications.	3			3	2	3	1	1		1				1	
CO2	Analyze the various combinational circuits using logic gate	3			3	2	3	1	1		1				1	
CO3	Implement various sequential circuits using logic gates	3		1	3	2	3	1	1		1				1	
CO4	Write VHDL code for various combinational circuits	3			3	2	3	1	1		1				1	
CO5	Understand the internal storage structures using different file and indexing techniques & advanced database concepts	3	2		3	2	3	1	1		1				1	

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		L	T	P	C
318CSP08	**DATABASE MANAGEMENT SYSTEMS LABORATORY**	0	0	2	1

OBJECTIVE(S):

- Create database with different types of integrity constraints and use the SQL commands such as DDL, DML & DCL to access data from database.
- Learn to implement SQL join operations & functions, Views
- To know the fundamental concepts of procedures & reports
- To design a database using different tools

Pre requisites: NIL

LIST OF EXPERIMENTS:

1. Create table for any schema & perform following operations
   - A. Add new fields, modify table & fields, remove any record & empty using DDL

Commands
   - B. Add new record, remove old record & update fields using DML Commands
   - C. Apply following constraints: Check, Default, Null, Primary & Foreign key
2. Create tables for any schema & perform Undo, Redo operations, User permission using DCL

Commands
3. Create any two tables & convert into normalized form using
   - A. Nested Queries
   - B. Join queries
   - C. Set Operations

4. Implement SQL functions such as Date, Character, general, Aggregate & number functions,etc...
5. Create trigger for update & modify database.
6. Implement PL/SQL Programs with Embedded SQL form
   - A. Control structures using Loop, if-else, While & for loop
   - B. Procedures to update & reflect in related tables
   - C. Using Functions
7. Create Horizontal view, Vertical view & perform following operations add, remove, join, check view updates
8. Design any simple program using VB / VC++.
9. Develop menu design for any schema using VB.
10. Display database details with oracle reports using manual & design wizard option.
11. Design & develop any schema with front-end tools using VB/VC++ with Database connection.
12. Study on Mongo DB.

Total Hours: 30

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COURSE OUTCOMES:

At the end of the course student should be able to

CO 1: Design and implement database schema for a given problem domain.

CO 2: Populate and query a database using SQL operations.

CO 3: Prepare reports.

CO 4: Design & develop an application using advanced databases.

LAB REQUIREMENTS:

HARDWARE AND SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

30 Personal Computers

Software:

Front end   : VB / VC ++

Back end   : MySQL, Oracle 11g, MongoDB Platform

: Windows 2000 Professional/XP or higher

Oracle server could be loaded and can be connected from individual PCs

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design and implement database schema for a given problem domain.	3				3	1	3	2							3
CO2	Populate and query a database using SQL operations.	3				3	2	2	2							2
CO3	Prepare reports.	3		1		3	2	2	2							2
CO4	Apply concurrency control and recovery mechanism.	3				3		3	2							3
CO5	Design & develop an application using advanced databases	3	2													

		L	T	P	C
318CSP09	**OOPS AND DATA STRUCTURES LABORATORY**	0	0	2	1

OBJECTIVES:

- To learn object oriented programming concepts using C++ to solve problem.
- To implement various concepts of OOP using C++.
- Efficiently implement the different Linear Data Structures using C++
- Build knowledge on Application of Trees and Graphs
- Learn to implement Searching, Sorting and hashing Algorithms.

PREREQUISITES : Nil LIST OF

EXPERIMENTS:

14 Hours

Implement the following concept using C++

1. Simple C++ programs using control structures, arrays, class and objects.
2. Constructors, Destructors.
3. Method and Operator Overloading
4. Inheritance, Data conversions.
5. Virtual function and virtual base class.
6. Templates(Function and Class) and **STL**
7. File operations and Exception handling

Implement the following Data Structure Programs using C++`

16 Hours

8. Linked List Implementation of Singly and Doubly Linked list.
9. Linked List Implementation of Stack and Queue
10. **Tree Traversal.**
11. Operation of Binary Search Tree.
12. **Graph Traversal.**
13. Applications of Graph (Dijikstras, Prims, Kruskal)
14. Searching and Sorting Algorithms
15. Hashing Techniques

Total Hours : 30

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Implement object oriented programming concepts.
CO2: Implement various file concepts, exception handling in object orientedProgramming
CO3: Implement programs for manipulating List, Stack and Queue ADT with itsApplications
CO4: Ability to apply and implement Tree and Graph Data Structures for Real TimeApplications.
CO5: Implement various Searching Sorting and Hashing Algorithms

LAB REQUIREMENTS:

HARDWARE AND SOFTWARE FOR A BATCH OF 30 STUDENTS

Hardware:
LAN System with 30 Nodes (OR) Stand-alone PCs -30 No's.Printer
– 3 No's.

Software:
OS: Windows / LinuxTurbo
C / C++.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Implement object oriented programming concepts.	3				3		2	2							
CO2	Implement various file concepts, exception handling in object oriented Programming	3				3		2	2							
CO3	Implement programs for manipulating List, Stack and Queue ADT with its Applications	3		1		3	3		2							3
CO4	Ability to apply and implement Tree and Graph Data Structures for Real Time Applications.	3	2			3	3	2	2							3
CO5	Implement various Searching Sorting and Hashing Algorithms	3				3	2	2	1							3

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	L	T	P	C
418DMT01 **DISCRETE MATHEMATICS**	3	0	0	4

Course Objectives:
- To master combinatorics which deals with the counting principles.
- To identify the basic properties of graph and model simple applications.
- To understand the concept of logic and hence to construct valid mathematical arguments.
- To expose the basic properties and concepts of algebraic structures.
- To introduce the concept of Lattices and Boolean algebra.

9+3

UNIT I   COMBINATORICS

Mathematical Induction – The basics of Counting Principle - The Pigeonhole principle -Permutations and Combinations – Recurrence relations- Solving linear recurrence relations - Generating functions – Inclusion and exclusion principle.

9+3

UNIT II   GRAPHS

Graphs – preliminaries - Types of graphs – properties – walks, trials and paths – Isomorphism of graphs – Matrix representations of graphs - Connectivity of a graph – Bipartitegraphs - Euler and Hamilton graphs - Colouring of graphs - Chromatic number of a graph.

9+3

UNIT III   LOGICS AND PROOFS

Propositional Logic – Propositional equivalences - Predicates and quantifiers – NestedQuantifiers Rules of inference - introduction to proofs – proof methods and strategy.

9+3

UNIT IV   ALGEBRAIC STRUCTURES

Algebraic systems – Semi groups and monoids – Groups-Subgroups and homomorphisms – Cosets and Lagrange's theorem– Rings & Fields.

9+3

UNIT V   LATTICES AND BOOLEAN ALGEBRA

Partial ordering – Posets – Lattices as Posets – Properties of lattices-Lattices as algebraicsystems – Sub lattices – direct product and Homomorphism – Some special lattices – Boolean algebra.

TOTAL = 45+15=60 PERIODS

Course Outcomes

At the end of the course the student will be able to

CO 1: understand and demonstrate the applications of basic concepts of an algorithm and counting principles in combinatorial mathematics.

CO 2: acquaint the graph theory concepts which serves as the base for the real time applications in network analysis.

CO 3: expertise the knowledge of logics helps to verify the correctness of computer programs and to draw conclusions from scientific experiments.

CO 4: internalize the abstract algebraic structures which provides the ability to deal thetheory of sequential machines, formal languages and syntactic analysis.

CO 5: Imbibe the concept of Lattices and Boolean algebra.

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TEXT BOOKS:
1. T.Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata McGraw–
   Hill Pub. Co. Ltd, New Delhi.

REFERENCES:
1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Seventh edition, Special Indian edition , Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2011.
2. Trembly J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer
   Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, thirtieth re-print 2007.
3. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth
   Edition, Pearson Education Asia, Delhi, 2007.
4. Thomas Koshy, ``Discrete Mathematics with Applications", Elsevier Publications, 2006.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	understand and demonstrate the applications of basic concepts of an algorithm and counting principles in combinatorial mathematics	3			3	3										1
CO2	acquaint the graph theory concepts which serves as the base for the real timeapplications in network analysis	3		1	3	3	2									1
CO3	Expertise the knowledge of logics helps to verify the correctness of computer Programs and to draw conclusions from scientific experiments.	3			3	3										1
CO4	Internalize the abstract algebraic structures which provides the ability to deal thetheory of sequential machines, formal languages and syntactic analysis.	3	2	1	3	3	1									1
CO5	Imbibe the concept of Lattices and Boolean algebra.	3			3	3										1

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	L	T	P	C
418CIT02 DESIGN AND ANALYSIS OF ALGORITHM	3	0	0	3

OBJECTIVE(S):

- Learn about Asymptotic Notations to solve Recurrence Equations.
- Understand various Algorithm Design Techniques like Divide and Conquer, Greedy Method, Dynamic Programming, Backtracking, Branch and Bound.
- Critically analyze the Efficiency of alternative Algorithm Solutions for Real World Problems.
- Learn about NP Class of Problems and their Variations.

Pre-requisites: Data Structures and Algorithms

UNIT-I   INTRODUCTION TO ALGORITHM ANALYSIS   9

Algorithm - Fundamentals of Algorithmic Problem Solving: Algorithm Design and Analysis Process - Algorithm Design Techniques - Methods of Specifying an Algorithm - Algorithm Analysis - Important Problem Types - Asymptotic Notations - Properties of Big-Oh Notation - Recurrence Equations - Solving Recurrence Equations: Substitution Method, Iteration Method - Master's Method.

UNIT-II   DIVIDE AND CONQUER AND GREEDY ALGORITHMS   10

Divide and Conquer: General Method - Binary Search - Finding Maximum and Minimum - Merge Sort - **Quick Sort** - Greedy Algorithms: General Method - Single Source Shortest Path Problem - Container Loading - Knapsack Problem - Huffman Codes.

UNIT-III   DYNAMIC PROGRAMMING AND ITERATIVE IMPROVEMENT   10

Dynamic Programming: General Method - Multistage Graphs - All Pair Shortest Paths - Optimal Binary Search Trees - 0/1 Knapsack - Travelling Sales Person Problem. Iterative Improvement: The Maximum Flow Problem - Maximum Matching in Bipartite Graphs - The Stable Marriage Problem.

UNIT-IV   BACKTRACKING AND BRANCH AND BOUND   9

Backtracking: General Method - 8 Queens Problem - Sum of Subsets - Graph Coloring - Hamiltonian Circuit Problem - Knapsack Problem. Branch and Bound: Least Cost Search - The 15 Puzzle Problems - FIBO Branch and Bound - LC Branch and Bound - 0/1 Knapsack Problem - **Assignment Problem.**

UNIT-V   NP-HARD AND NP-COMPLETE PROBLEMS   8

Basic Concepts: The Class NP-Hard and NP-Complete - **NP Hard Graph Problems - Clique Decision Problem** - Node Cover Decision Problem - Chromatic Number Decision Problem - NP Hard Scheduling Problem - Flow Shop Scheduling - Job Shop Scheduling.

TOTAL: 45 Hours

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COURSE OUTCOMES:

At the end of the course the students are able to:

CO1: Design Algorithms for various Computing Problems.

CO2: Design and analyze algorithm using Divide and Conquer, Greedy Techniques

CO3: Solve and analyze problems using Dynamic programming and iterative improvement

CO4: Analyze back tracking and Branch and Bound algorithm

CO5: Identify any Problem as belonging to the Class of P and NP.

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms /C++, Second Edition, Universities Press, 2007.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Harsh Bhasin, "Algorithms: Design and Analysis", Oxford University Press, 2015.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Design Algorithms for various Computing Problems	3				2	2		1	2			1		1	
CO2 Design and analyze algorithm using Divide and Conquer, Greedy Techniques	3		1		2	2			1	2				2	
CO3 Solve and analyze problems using Dynamic programming and iterative improvement	3			2		2	2		2		2		1		
CO4 Analyze back tracking and Branch and Bound algorithm	3		1			1			1	2		2			
CO5 Identify any Problem as belonging to the Class of P and NP.	3	2			2		1	2	1	2				1	

L	T	P	C
0	0	2	1

418CSP09   COMPUTER NETWOKS LABORATORY

OBJECTIVE(S):

- Get familiarized with socket programming
- Understand the basic networking commands
- Analyze the performance of protocols in different layers using simulation tools.

Prerequisite: Programming in C, Object Oriented Programming

LIST OF EXPERIMENTS:

1. Basic network command line utilities such as ping, netstat, tracert, nslookup, port scan, ARP, ipconfig.

Implement the following experiments in C/C++/Java:

2. Generate Hamming code for error detection and correction
3. Implement Error Detection code using CRC
4. Implementation of stop and wait protocol
5. Implementation of sliding window protocol
6. Implementation of UDP
7. Implementation of TCP

Implement the following experiments using simulator:

8. Study of Basic concepts of Network Simulator (NS2), its installation and working environment.

9. Using NS2 Network Simulation,

   i) Initialize & Network simulator object.

   ii) Group of Nodes to form a LAN

   iii) Delay of Link

   iv) Bandwidth of Link.

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10. Simulate a four Duplex network and apply TCP agent between two nodes and UDP agents between other two nodes and by changing the parameters, determine the number of packets sent and dropped byTCP/UDP.

11. Simulate a wired network and measure the following performance metrics

    i) Throughput   ii)Delay   iii) PacketLoss

12. Implement Link State routing and Distance Vector routing measure the following performance metrics

    i) Throughput   ii) Delay   iii) PacketLoss

13. **Experiment on packet capture and network traffic using wire sharktool.**

                                               TOTAL: 30 Hours

COURSE OUTCOMES:
At the end of the course student should be able to
    CO1: Gain knowledge on the basic concepts of open source network simulator.
    CO2: Analyze and implement various routing algorithms. **CO3:**
    Simulate networks and analyze traffic using various tools.
    CO4: Analyze the performance of protocols in different layers.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Gain knowledge on the basic concepts of open source network simulator	3			2				2					1		1
CO2 Analyze and implement various routing algorithms.	3		1	1		2							1		2
CO3 : Simulate networks and analyze traffic using various tools.	3	2		1			2	2					2		
CO4 Analyze the performance of protocols in different layers.	3			1			2	1					1		2

Course Objectives
- To impart the knowledge of basic probabilistic theory.
- To learn one dimensional discrete and continuous probability distributions occurring in naturalphenomena.
- To extend the probability theory to two dimensional random variable and to study the statisticalmeasures.
- To study the classification and analysis of few random process.
- To acquire the skills to analyze queueing models.

UNIT I   PROBABILITY AND RANDOM VARIABLE   9+3

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions and their properties, Applications of mgf.

UNIT II   PROBABILITY DISTRIBUTIONS   9+3

Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions and their properties - Functions of a random variable-simple applications.

UNIT III   TWO-DIMENSIONAL RANDOM VARIABLES   9+3

Joint distributions – Marginal and Conditional distributions –Covariance–Correlation and Linear regression – Central limit theorem (Statement and applications only for independent and identically distributed random variables).

UNIT IV   RANDOM PROCESSES   9+3

Classification – Stationary process – Poisson process - Markov process – Discrete parameter Markov chain – Chapman Kolmogorov equations-Application problems for each process.

UNIT V   QUEUEING THEORY   9 + 3

Markovian queues – Little's formula –Models: (M/M/1): (⧄/FIFO), (M/M/s): (⧄/FIFO) ,(M/M/1): (k/FIFO),   (M/M/s): (k/FIFO) – Non-Markovian Queues: Pollaczek-Khinchinformula(statement and applications only) - (M/G/1): (⧄/GD).

TOTAL: 45 + 15 = 60 PERIODS

Course Outcomes
At the end of the course the student will be able to
CO 1: Imbibe the knowledge of basic probability.
CO 2: Improve the quality of interpretation and decision making in real time problems of probability distributions.
CO 3: Learn the concept of two dimensional random variables which helps to understand and analyse the statistical measures which describes the outcome of a random experiment.
CO 4: Understand and characterize the random variable phenomenon which evolve with respect to timein a probabilistic approach.
CO 5: Construct and solve queuing models that are suitable for practical problems encountered in dailylife.

TEXT BOOKS

1. Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1stIndian Reprint, 2007.
2. Gross, D., Shortle, J.F., Thompson, J.M. and Harris, C.M., Fundamentals of Queuing Theory, 4thEdition, John Wiley and Sons, New York, 2016.

REFERENCES

1. HweiHsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables andRandom Processes", Tata McGraw Hill, New Delhi, 9th Reprint, 2010.
2. Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishingcompany Limited, New Delhi, 2014.
3. Kandasamy.P,Thilagavathy,K.,&Gunavathi.K., "Probability, Statistics and Queueing Theory"., S.Chand& Company Ltd., New Delhi, 2014.
4. Gupta.S.C.,&Kapoor,V.K., "Fundamentals of mathematical statistics", 10th edition(Reprint),Sultan Chand & Sons publishers, New Delhi, 2002.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Imbibe the knowledge of basic probability.	3			3	3										1
CO2 Improve the quality of interpretation and decision making in real time problems of probability distributions.	3			3	3	2									1
CO3 Learn the concept of two dimensional random variables which helps to understand and analyse the statistical measures which describes the outcome of a random experiment.	3		1	3	3	1									1
CO4 Understand and characterize the random variable phenomenon which evolve with respect to time in a probabilistic approach	3			3	3	2									1
CO5 Construct and solve queuing models that are suitable for practical problems encountered in daily life	3	2		3	3	2									1

		L	T	P	C
518CIT02	Microprocessors and Microcontroller	0	0	2	1

Course Objectives:
- Summarize the architecture and assembly language programming of microprocessors
- Defend the architecture and assembly language programming of microcontrollers
- Demonstrate the concept of interrupts and interfacing with various peripherals.
- Integrate the features of a microcontroller and its timer applications.
- Justify the architectural features of 801XX with 8086 processor.

UNIT I   8086 MICROPROCESSOR   9

Intel 8086 microprocessor – Architecture - Minimum and Maximum mode Configuration – Signals(Pin Configuration)- Instruction Set-Addressing Modes-Assembly Language Programming-Assembler Directives-Interrupts And Interrupt Service Routines.

UNIT II   MEMORY AND I/O INTERFACING   9

Memory interfacing and I/O interfacing with(8086) – parallel communication interface – serial communication interface – timer-keyboard/display controller – interrupt controller – DMA controller(8257).

UNIT III   8051 MICROCONTROLLERS   9

Architecture of 8051 Microcontroller (Pin Configuration) – I/O ports – memory – counters and timers-serial data I/O – interrupts

UNIT IV   INTERFACING WITH 8051   9

Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing withDACs-Stepper Motor.

UNIT V   MICROPROCESSOR TECHNOLOGY   9

Architecture of Intel 80286,80386,80486 –Features of Pentium I and II processors

TOTAL: 45 Hours

Course Outcomes:

Upon Completion of this course, students will be able to :

CO 1: Recognize the basic Microprocessor architecture and its concepts.

CO 2: Outline the concepts of peripheral interfacing mechanisms.

CO 3: Design various assembly language programming using microprocessors andmicrocontroller.

CO 4: Extend the real world interfacing with microcontroller

CO 5: Extrapolate the architectural features of 801XX with 8086 processor.

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Text Books

1. Yn-cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", second edition, Prentice Hall of India , 2006
2. Kenneth J. Ayala, 'The 8051 microcontroller Architecture, Programming and applications' second edition , Penram international.
3. Mohamed Ali Mazidi, Janice Gillispie Mazidi," The 8051 microcontroller and embedded systems using Assembly and C", second edition, Pearson education /Prentice hall of India , 2007.
4. The Intel Microprocessor Architecture, Programming and Interfacing, Barry B. Brey ,6th edition, Pearson education, 2002.

Reference Books

1. Douglas V.Hall, "Microprocessors and Interfacing: Programming and Hardware", second edition,Tata Mc Graw Hill, 2006.
2. A.K.Ray & K.M Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata Mc Graw Hill, 2006.
3. Peter Abel, "IBM PC Assembly language and programming", fifth edition, Pearson education / Prentice Hall of India Pvt.Ltd, 2007.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Recognize the basic Microprocessor architecture and its concepts.	3			3	2	3	1	3						1	
CO2 Recognize and develop sophisticated queries and authorization techniques to extract information from database	3		1	3	2	3	1	3						1	
CO3 Design various assembly language programming using microprocessors and microcontroller	3			3	2	3	1	3						1	
CO4 Extend the real world interfacing with microcontroller.	3			3	2	3	1	3						1	
CO5 Extrapolate the architectural features of 801XX with 8086 processor	3	2		3	2	3	1	3						1	

	L	T	P	C
518CST03 OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	0	3

OBJECTIVE(S):

- ▢ To understand and differentiate Unified Process from other approaches
- ▢ To study the concepts of modeling in object oriented concepts
- ▢ To learn about Unified Modeling Language
- ▢ To design with the UML static, dynamic and implementation diagrams
- ▢ To learn design techniques and methodologies.

Prerequisite: Software Engineering and Object Oriented Programming

UNIT- I   INTRODUCTION   10

An Overview of Object Oriented Systems Development - Object Basics – Objects and Classes- Abstraction- Encapsulation- Inheritance- Polymorphism Object Oriented Systems Development Life Cycle **OOAD Methodologies** - Rumbaugh Methodology - Booch Methodology – Jacobson Methodology - Patterns – Frameworks – Unified Approach

UNIT- II   SYSTEM MODELLING   11

Introduction to Unified Modeling Language – Usage of UML - Types of UML Diagrams **USE CASE MODELING** - Understanding Use cases-Identifying Use cases-Association between use cases (uses and Extends)-Describing use cases-Dividing Use cases into packages- Naming a Use case - Use case Diagram **OBJECT MODELING:** Class diagrams, associations, generalization, composition, object diagrams, associations, aggregation and composition **DYNAMIC MODELING:** Interaction diagrams, sequence diagrams, collaboration diagrams, state diagrams, activity diagrams. **IMPLEMENTATION MODELING:** Package diagrams, deployment diagrams, componentdiagrams, combining component and deployment diagrams.

UNIT- III   OBJECT ORIENTED ANALYSIS   8

Object Analysis - Classification – Identifying Object relationships - Attributes and Methods

UNIT- IV   OBJECT ORIENTED DESIGN   8

Design axioms - Designing Classes – Access Layer - Object Storage - Object Interoperability.

UNIT-V   USER INTERFACE DESIGN   8

Designing Interface Objects – Designing View layer classes – Macro-Level Process - Micro- Level Process – Purpose of a View Layer Interface – Prototyping the User Interface - Case study:Designing user Interface for the Vianet Bank ATM.

TOTAL: 45 Hours

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Apply Object Oriented Methodologies and Unified Modeling Approach to develop a system model.

CO2: Analyze, identify object relationship, attributes and methods to build a class.

CO3: Use the UML analysis and design diagrams.

CO4: Create UML for requirements, designs and component interfaces

CO5: Design classes, user interface and to have wide knowledge on object storage and interoperability to develop an effective model.

TEXT BOOK:

1. Ali Bahrami, "Object Oriented Systems Development", Tata Mc Graw-Hill, New Delhi,1st Edition, 2008.

REFERENCE BOOKS:

1. James Rumbaugh, Ivar Jacobson, Grady Booch, "The Unified Modeling Language User Guide", Pearson Education, 3rd Edition, 2012.

2. Hans-Erik Eriksson, Magnus Penker, Brain Lyons, David Fado, "UML 2 Toolkit", OMGPress Wiley Publishing Inc., New Delhi, 2011.

3. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education, 3rd Edition, 2012.

4. Mahesh P Matha, "Object Oriented Analysis and Design using UML", PHI Learning,New Delhi, 2008.

5. Martin Fowler, "UML Distilled", 3rd Edition, PHI Learning, New Delhi, 2015.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply Object Oriented Methodologies and Unified Modeling Approach to develop a system model	3		1		3	3		2	2	1					2
CO2	Analyze, identify object relationship, attributes and methods to build a class.	3				3	3		2	2	1					2
CO3	Use the UML analysis and design diagrams	3				3	3		2	2	1					2
CO4	Create UML for requirements, designs and component interfaces	3	2			3	3		2	2	1					2
CO5	Design classes, user interface and to have wide knowledge on object storage andinteroperability to develop an effective model.	3				3	3		2	2	1					2

518CIT04	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

OBJECTIVE(S):

- Design a deterministic and non-deterministic finite automata.
- Construct automata for any given pattern and find its equivalent regular expressions
- Design a Pushdown Automata and Context free language.
- Understand the Turing machines and computing with Turing machines.
- Understand the fundamentals of decidability and Reducibility.

UNIT– I   INTRODUCTION TO AUTOMATA   9

Sets – functions – relations – Languages– Basic Machines - Finite Automata – Basic definitions– Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA) – Finite automata with Epsilon transitions –Equivalence of DFA`s and NFA`s - Applications of finite state automata.

UNIT– II   REGULAR EXPRESSIONS AND LANGUAGES   9

Regular languages - Regular Expressions – Finite automata and regular expressions – Properties of regular sets–Properties of Regular Language: Proving languages not to be Regular (Pumping Lemma for Regular Language), Closure properties of Regular Language, Equivalence and Minimization of Automata.

UNIT– III CONTEXT FREE LANGUAGES AND PUSH DOWN AUTOMATA   9

Context Free Grammar (CFG) – Derivation trees – Ambiguity-Normal Forms, Chomsky Normal

Form (CNF) Griebach Normal Form (GNF)– Introduction to Push Down Automata (PDA) – PDA definition – Equivalence of PDA and Context Free Grammar –Deterministic pushdown automata – Properties of Context Free Languages.

UNIT– IV   TURING MACHINES   9

Church-Turing thesis: Turing machines - Language of a TM, TM as accepters and deciders. Programming techniques for TM -Storage in state, multiple tracks, and subroutines. Variants of Turing Machines-**Encoding of a TM**-Universal Turing machine.

UNIT– V   DECIDABILITY AND REDUCIBILITY   9

Decidability: Decidable languages Halting problem: Diagonalization Method-Halting Problem is Undecidable-Reducibility: Undecidable problems from Language theory –Rice theorem and **Properties of RE Languages** - A simple Undecidable problem: Post's Correspondence Problem (PCP) –**Modified PCP-MPCP to PCP**-Undecidability of PCP.

TOTAL: 45 Hours

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Construct automata, regular expression for any pattern.

CO2: Design grammars and Automata (recognizers) for different language classes.

CO3: Write Context free grammar for any construct

CO4: Design Turing machines for any language and propose computation solutions using Turing Machines

CO5: Derive whether a problem is decidable or not

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TEXT BOOKS:

1. John E. Hopcroft and Rajeev Motwani and Jeffrey D. Ullman, "Introduction to AutomataTheory, Languages and Computation", third edition, Pearson Education, New Delhi, 2014.

2. John C. Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition,Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011.

3. Rajendra Kumar, "Theory of Automata Languages and Computation", first edition Tata McGrawHill Education Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

1. S.N.Sivanadam , M.Janaki Meena, " Theory of Computation" , I.K.International Publishing HousePvt. Ltd, ISBN: 9789380026206, 2009.

2. Michael Sipser , "Introduction to the Theory of Computation", third edition, PWS Publications,Boston, 2013.

3. Harry R. Lewis, Chris H Papadimitriou, "Elements of the Theory of Computation", SecondEdition, PHI / Pearson Education, New Delhi, 1997.

4. Peter Linz, "An Introduction to Formal Language and Automata", fifth edition, Narosa Publishers,New Delhi, 2011.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Construct automata, regular expression for any pattern	3			1		2	3						1		2
CO2	Design grammars and Automata (recognizers) for different language classes	3		1	1		2	3								2
CO3	Write Context free grammar for any construct	3			1		2	3								2
CO4	Design Turing machines for any language and propose computation solutions using Turing Machines	3	2		1		2	3								2
CO5	Derive whether a problem is decidable or not	3			1		2	3								2

| | | L | T | P | C |

Course Objectives:

At the end of the course ,the students should be able to:

- Develop the code in assembly language programming.
- Test the developed code using 8086 processors and 8051 controllers.
- Demonstrate the interface peripherals with microprocessor andmicrocontroller
- Integrate the peripherals for real world applications.
  Design the various ALU for analysis of microprocessor and microcontroller

LIST OF EXPERIMENTS

I. **8086 based Experiments**

1. 16 bit arithmetic operation using 8086.

2. Generate a Fibonacci series using 8086.

3. Searching Largest Number and Smallest Number in an array using 8086.

4. To generate factorial of number using 8086.

5. String manipulation using 8086.

II. **8051 based experiments**

6. 8-bit arithmetic operations using 8051 microcontroller

7. Design of simple ALU using 8051 microcontroller.

8. Searching Largest Number and smallest number in an array using 8051.

9. 9.Solve the logic equations using 8051 microcontroller.

III. **Interfacing Experiments with 8086/8051**

10. Traffic light controller

11. Stepper motor interfacing

12. 12.8279 keyboard/display controller

13. 13.ADC and DAC interfacing

Course Outcomes:

Upon Completion of this course, students will be able to :

CO1 : Generate the code for arithmetic operations in assembly language

CO2 : Generalize the developed code using 8086 processors and 8051 controllers.

CO3 : Reorganize the Interfacing peripherals with microprocessor and microcontroller

CO 4 : Interpolate the peripherals for real world applications.

CO 5 : Propose the various ALU for analysis of microprocessor and microcontroller

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Generate the code for arithmetic operations in assembly language	3			3	2	3	1	3						1	
CO2	Generalize the developed code using 8086 processors and 8051 controllers	3		1	3	2	3	1	3						1	
CO3	Reorganize the Interfacing peripherals with microprocessor and microcontroller	3			3	2	3	1	3						1	
CO4	Interpolate the peripherals for real world applications.	3	2		3	2	3	1	3						1	
CO5	Propose the various ALU for analysis of microprocessor and microcontroller	3			3	2	3	1	3						1	

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OBJECTIVE(S):

The student should be made to:

- Learn the basics of OO analysis and design skills.
- Get exposed to the UML design diagrams.
- Learn to map design to code.
- Be familiar with the various testing techniques.

Prerequisite: Fundamentals of Computing & C Programming, Object Oriented Programming

LIST OF EXPERIMENTS:

Prepare the following documents for two or three of the experiments listed below and develop the software engineering methodology.

1. **Project Analysis** - Prepare Project Plan by Thorough study of the problem – Identifying project scope, Objectives, Infrastructure.

2. **Software requirement Analysis** - Describe the individual Phases / Modules of the project, Identify deliverables.

3. **System Modeling** - Preparing Class Diagram, Object Diagram, Interaction diagrams, sequence diagrams, collaboration diagrams, state diagrams, activity diagrams, Package diagrams, deployment diagrams, component diagrams.

4. **Data Modeling** - E-R Diagrams and Data dictionary

5. **Software Development and Debugging**

6. **Software Testing** - Prepare test plan test cases and perform validation testing.

SUGGESTED LIST OF APPLICATIONS

1. Payroll System
2. Library Management System
3. Feedback System
4. Internal Marks System

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5. Quiz System
6. Online Ticket Reservation System
7. Course Registration System
8. Dashboard System
9. ATM Systems
10. Stock Maintenance
11. Real-Time Scheduler   **TOTAL: 45 HOURS**
12. Deposit Monitoring System

COURSE OUTCOMES:
At the end of the course student should be able to

CO1: Prepare a project plan by analyzing project scope and objectives by using OO concepts.
CO2: Design & develop UML diagrams.
CO3: Get knowledge on Argo UML tool for developing UML diagrams.
CO4: Compare test cases, test plan for an application project

LIST OF EQUIPMENTS AND SOFTWARE FOR A BATCH OF 36 STUDENTS

PC   :   36 Nos.

OS   :   Windows 2000/ Windows XP/ NT (or) Higher

Software :   ArgoUML (freeware) – to be installed in all PC's.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Prepare a project plan by analyzing project scope and objectives by using OO concepts.	3				3	3		2	2	1					2
CO2 Design & develop UML diagrams.	3		1		3	3		2	2	1					2
CO3 Get knowledge on Argo UML tool for developing UML diagrams.	3				3	3		2	2	1					2
CO4 Compare test cases, test plan for an application project	3	2			3	3		2	2	1					2

		L	T	P	C
518CIP08	**EMPLOYABILITY SKILLS LABORATORY**	1	0	3	1

Course Objectives:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them enrich their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their career.
- To enhance the performance of the students in the recruitment processes, self enhancement and launching start ups.

Unit I: Listening 7

Listening Audios and answering MCQs - Watching video clips on famous speeches, motivational videos, documentaries and answering MCQs - Listening Comprehension and TED talks.

Unit II: Speaking 10

Prepared talk - Extempore - story knitting - Picture Talk - Brainstorming - Debate - Group Discussion - Elevator Speech - Mock HR Interviews - Story Narration - Miming - Short Skits.

Unit III: Reading 12

Reading Comprehension - Verbal Analogy - Classification - Alphabet Test - Logical Sequence of Words - Statement & Conclusions - Statement & Courses of Action - Situation Reaction Test -Theme Detection - Deriving Conclusions from Passages.

Unit IV: Writing 7

Business Letters - Email Writing - Essay Writing - Paragraph Writing - Paraphrasing.

Unit V: Career Skills 9

Vocabulary Test (GRE, TOEFL, TOEIC & CAT Exam words) - Confused Pair of words - Contronyms - One Word Substitution - Sequencing of Sentences – Sentence correction.

TOTAL : 45 PERIODS

Lab Requirements:
1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Course Outcomes:

On completion of the course, the students shall have the ability to:

CO1: Comprehend the various strategies of listening and its significance.
CO2: Articulate their views clearly and concisely with self-confidence and persuasiveness.
CO3: Understand the prevailing practices of testing in the recruitment process by the corporatesand the institutional selection processes.
CO4: Communicate the corporate and social requirements in an impressive written mode.
CO5: Enhance their verbal skills in the screening tests competently both for recruitment and pursuing higher studies as well.

Text Books:

1. Agarwal R. S., A Modern Approach to Verbal and Non-verbal Reasoning, Chand & Co.,New Delhi, 2012.
2. Ashraf Rizvi M. Effective Technical Communication. TATA McGraw Hill, New Delhi: 2007.

References:

1. Lingua: Essays for TOEFL/IELTS, Dreamtech Press, New Delhi, 2016.
2. Lily Mangalam, Global English Comprehension, Allied Publishers Pvt. Ltd., New Delhi,2014.
3. Sharon Weiner Green and Ira K. Wolf, Barron's GRE, Glagotia Publications Pvt. Ltd.,18th Edition, New Delhi, 2011.
4. Mohamed Elias, R. Gupta's IELTS/TOEFL Essays, Ramesh Publishing House, 6th Edition,New Delhi, 2016.

	Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Comprehend the various strategies of listening and its significance.	3		1			3			2	1					
CO2	Articulate their views clearly and concisely with self-confidence and persuasiveness.	3				2				1	1					
CO3	Understand the prevailing practices of testing in the recruitment process by the corporates and the institutional selection processes.	3								2	1					
CO4	Communicate the corporate and social requirements in an impressive written mode.	3	2							1	1					
CO5	Enhance their verbal skills in the screening tests competently both for recruitment and pursuing higher studies as well.	3									1					

OBJECTIVE(S):

- To understand the fundamentals of .NET Programming
- To develop realtime applications using C#
- To update and enhance skills in writing Windows applications,ADO.NET and ASP.NET.

Prerequisite: Object Oriented Programming.

UNIT-I   C# LANGUAGE FUNDAMENTALS   9

The Building Block of the .NET Platform (CLR,CTS, and CLS) – Overview of Assemblies - The Anatomy of a Simple C# Program - Defining Classes and Creating Objects - The System Console Class-Establishing Member Visibility - Default Values of Class Member Variables- Member Variable Initialization Syntax- Static Keyword - Method Parameter Modifiers - IterationConstructs - Decision Constructs and the Relational / Equality Operators - Understanding Value Types and Reference Types- Boxing and Unboxing - Working with .NET Enumerations - Overriding Some Default Behaviors of System. Object - The System Data Types - String Data Type - .NET Array Types - Custom Namespaces.

UNIT-II   OBJECT ORIENTED PROGRAMMING WITH C#   9

Understanding the C# Class Type - Reviewing the Pillars of OOP - The First Pillars: C#'s Encapsulation Services, The Second Pillar: C#'s Inheritance Support - Programming for Containment/Delegation - The Third Pillar: C#'s Polymorphic Support-C# Casting Rules - Understanding Object Lifetime - Basics of Object Lifetime - Role of Application Roots - Garbage Collection - Building Finalizable and Disposable Types. Exception Handling - Throwing a Generic Exception - Catching Exceptions.

UNIT-III   INTERFACES, COLLECTIONS, DELEGATES, EVENTS AND LAMDAEXPRESSION   9

Defining Interfaces in C#-Implementing an Interface in C# - Contrasting Interfaces to Abstract Base Classes-Building Interface Hierarchies - Building Enumerable Types (IEnumerable and IEnumerator) Building Cloneable Objects (ICloneable) -Building Comparable Objects (IComparable) -The Interfaces of the System - Collections Namespace - Defining a Delegate in C# -Simplest Possible Delegate Example-Enabling Multicasting -C# Events - LamdasExpression.

UNIT-IV   DEVELOPING WINDOW APPLICATION FORMS   9

Windows Forms Types - Application Class- Functionality of the Control Class - Functionality of the Form Class- Building Windows Applications - Working with StatusStrips - Working with ToolStrips - Building an MDI Application - Basic Controls.

UNIT-V   ADO.NETAND ASP.NET   9

ADO.NET Overview – Using Database Connections, Commands, The Data Reader, The DataSet Class,ASP.NET Introduction – Web Forms – ADO.NET and Data Binding-ASP.NET Features – User and Custom Controls – Master Pages- Site Navigation – Security.

TOTAL: 45 HOURS

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COURSE OUTCOMES:

At the end of the course students should be able to:

CO1: Understand anatomy of C# Programming

CO2: Develop Console application using object oriented concepts, advanced features in C#.

CO3: Develop Window form application with Database connectivity.

CO4: Build Applications using ADO.NETAND ASP.NET.

TEXT BOOKS:

1. Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework" Apress, Sixth Edition,2012ISBN: 978-1-4302-4233-8

2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

REFERENCE BOOKS:

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012.

2. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2004.

3. O`Reilly "Programming C# 5.0" ,O'Reilly Media ISBN: 978-1-4493-2041-6 | ISBN 10:1-4493-2041-4, October 2012.

4. Michael Schmalz "C# Database Basics" O'Reilly Media ISBN:978-1-4493-0998-5, 2012

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand anatomy of C# Programming	3			3		1									2
CO2	Develop Console application using object oriented concepts, advanced features in C#.	3		1	3	2	2	3								1
CO3	Develop Window form application with Database connectivity.	3			2	2	1	2								1
CO4	Build Applications using ADO.NETAND ASP.NET.	3	2		2	2	1	2								2

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	L	T	P	C
518CSE02 **SCRIPTING LANGUAGE**	3	0	0	3

PREREQUISITE: Fundamentals of Computing and C Programming, Object oriented programming

OBJECTIVES:

- Demonstrates an in depth understanding of tools and scripting languages necessary for design and development of applications.
- Explores the nature of scripting and provides skills in scripting language design.
- Learn to write simple scripts to automate system using appropriate languages.
- Conceive basics of text processing, client and server level scripting and GUI programming.

UNIT I   INTRODUCTION TO SCRIPTING AND PERL   9

Scripts and Programs - Origin of Scripting - Characteristics of Scripting Languages - Uses of Scripting Languages - Web Scripting. Perl backgrounder- Perl overview - Perl parsing rules - Variables and Data - Statements and Control structures –Subroutines - Packages - Modules - Working with Files - Data Manipulation.

UNIT II   Introduction to PHP   9

Introduction - Programming in web environment - variables – constants - data types - operators - Statements - Functions - Arrays – OOP: Classes and Objects-Constructor- Inheritance- Overloading and overriding - String Manipulation and regular expressions - File handling and data storage.

UNIT III PHP and MySQL   9

Setting up webpages to communicate with PHP – Handling Form Controls -PHP and MySQL database - PHP Connectivity - Sending and receiving E-mails - Debugging and error handling - PHP Frameworks: Codeignter – Laravel.

UNIT IV   OOC AND DB INTEGRATION IN PYTHON   9

Python Basics - Introduction to OOC – Classes and Instances – Static and Class Methods – Composition – Inheritance – Built-in Functions – Integrated Web Applications in Python - Python and MySQL Database Integration: Connect Database – Create and Insert Operations – Parameter Passing – Retrieving data from Database. Case Study on SciPy, Django, Open CV.

UNIT V   Introduction to Ruby   9

Introduction to Ruby - Core Programming Elements – Conditional Structures – Loop Structures – Arrays – Using Objects - Defining Classes and Creating Objects - Object Inheritance – File Input/Output.

TOTAL HOURS: 45 HOURS

COURSE OUTCOMES:

At the end of the course the students should be able to

    CO1: Apply Perl scripts in application development and data analysis
    CO2: Develop Web based application using PHP and MySQL
    CO3: Design and implement short and efficient Python scripts for longer constructs.
    CO4: Illustrate Ruby scripts in application development

TEXT BOOKs

1. Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2012.
2. Steve Suehring, "PHP6& MySQL Bible", John Wiley Publishing Inc., Reprint 2010.
3. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2010.
4. Ophir Frieder, Gideon Frieder and David Grossman, "Computer Science Programming Basics with Ruby", First Edition, O'Reilly, 2013.

REFERENCES

1. RasmusLerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2012.
2. Tom Christiansen, Jon Orwant, Larry Wall, Brian Foy, "Programming Perl", 4th Edition, O'Reilly Media, 2012.
3. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2010.
4. Paul Barry, "Head First Python", O'Reilly Media, 2010.
5. Garrett Grolemund, "Hands-On Programming with R", Paperback Edition, O'Reilly Media, 2016.
6. Colin Gillespie and Robin Lovelace, "Efficient R Programming", First Release, O'Reilly,2016.

ONLINE REFERENCES

1. https://www.perl.org/
2. http://php.net/manual/en/
3. http://www.learnpython.org/
4. http://www.pythontutor.com/
5. http://www.diveintopython3.net./

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply Perl scripts in application development and data analysis.	3	1		3	2		2								2
CO2	Develop Web based application using PHP and MySQL	3			3	3		2								2
CO3	Design and implement short and efficient Python scripts for longer constructs.	3	2		2	3		2								2
CO4	Illustrate Ruby scripts in application development	3			3	2		2								2

		L	T	P	C
618CST01	MOBILE APPLICATION DEVELOPMENT	3	0	0	3

Prerequisites: Java Programming

OBJECTIVE(S):
- To learn the characteristics of mobile applications.
- To learn about the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

UNIT –I   GETTING STARTED WITH MOBILITY   9

Mobility landscape, Mobile platforms – Apple iPhone Platform- Google Android Platform – Eclipse Simulator, Mobile apps development, setting up the mobile app development environmentalong with an emulator - Case Study on Mobile App development.

UNIT-II   BUILDING BLOCKS OF MOBILE APPS – I   9

App user interface designing – mobile UI resources (Layout, UI elements, Drawable Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, A Sync task, Services – states and lifecycle, Notifications.

UNIT-III   BUILDING BLOCKS OF MOBILE APPS – II   9

Broadcast receivers, Telephony and SMS APIs , Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)

UNIT-IV   SPRUCING UP MOBILE APPS   9

Graphics and animation – custom views, canvas, animation APIs, multimedia – Audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)

UNIT-V   TESTING MOBILE APPS AND TAKING APPS TO MARKET   9

Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps,JUnit for Android, Robotium, MonkeyTalk, Versioning, signing and packaging mobile apps, distributing apps on mobile market place.

TOTAL: 45

COURSE OUTCOMES:
At the end of the course students should be able to
CO1: Familiarize with Mobile apps development aspects.
CO2: Design and implement the user interfaces for mobile applications
CO3: Develop useful mobile applications using Google Android and Eclipse simulator.
CO4: Develop mobile applications using graphics and animation
CO5: Perform testing, signing, packaging and distribution of mobile apps

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TEXT BOOK:

1. Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition, Wiley India, (2013)

REFERENCE BOOKS:

1. Barry Burd , "Android Application Development All in one for Dummies", FirstEdition , Wiley India ,(2011)

2. Lauren Darcey , Shane Conder, "Teach Yourself Android Application Development In 24 Hours", Second Edition, Wiley India , (2012)

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Familiarize with Mobile apps development aspects .	3			3	1	3	2	3	2						
CO2	Design and implement the user interfaces for mobile applications	3		1		1		2		2						
CO3	Develop useful mobile applications using Google Android and Eclipse simulator	3	2		3	1	2	2	1							
CO4	Develop mobile applications using graphics and animation	3			2	1	3	2								
CO5	Perform testing, signing, packaging and distribution of mobile apps	3				1					1					

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COMPILER DESIGN

L	T	P	C
3	0	0	3

PREREQUISITES: Object Oriented Programming, Theory of Computation.

OBJECTIVES

- Understand the phases of compiler.
- Learn the role of a parser and different ways of recognizing and parsing of tokens.
- Perceive the various storage allocation techniques.
- Acquaint how to generate and optimize the code.

UNIT I   INTRODUCTION TO COMPILER   9

Compilers - Structure of a Compiler - Role of lexical analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens – Lexical-Analyzer Generator-**Finite Automata-Regular Expression to FA-Optimization of DFA.**

UNIT II   SYNTAX ANALYSIS AND SYNTAX DIRECTED TRANSLATION   11

Role of the parser - Top Down parsing – Recursive Descent Parser - Predictive Parser - LL(1) Parser -Shift Reduce Parser - LR Parser – Operator Precedence - Construction of SLR Parsing table - LALR Parser – **Syntax Directed Definitions – Construction of Syntax Trees – S-AttributedDefinitions – L-Attributed Definitions**

UNIT III   INTERMEDIATE CODE GENERATION   9

Intermediate Languages - Variants of syntax Tree-Generation of Three Address Code – Types and Declarations -Assignment Statements - Arrays - Boolean Expressions - Back patching - Case Statements - Procedure Calls.

UNIT IV   RUN-TIME ENVIRONMENT AND CODE GENERATION   8

Storage Organization - Storage Allocation - Access to Non-Local Names –**Heap Management** -Issuesin design of a code generator – The target machine – Instruction costs – Basic Blocks and Flow Graphs - A simple code generator

UNIT V   CODE OPTIMIZATION   8

Introduction to optimization – Peephole Optimization-Principal Sources of Optimization – Optimization of Basic Blocks –. Global Data Flow analysis-**Constant Propagation-Partial Redundancy Elimination-loops in Flow Graphs**

TOTAL HOURS: 45

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COURSE OUTCOMES

At the end of the course, the student should be able to:

CO 1: Understand the phases of compiler and recognize tokens from language specifications. **CO2:** Create framework for syntax directed translation schemes, and parse the generated tokens.
CO3: Construct the intermediate code representation and generation
CO4: Develop a simple compiler by using different compiler construction tools**CO5:** Apply the optimization technique to generated optimized code

TEXT BOOK

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, —Compilers: Principles,Techniques and Tools, Second Edition, Pearson Education, 2014(reprint).

REFERENCES

1. Dhamdhere D M, "Compiler Construction Principles and Practice" second edition, MacmillanIndia Ltd., New Delhi, 2005.
2. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", McGraw Hill, New Delhi, 2007.
3. Dick Grone, Henri E Bal, Ceriel J H Jacobs and Keen Gangendoen, Modern Compiler Design", John Wiley, New Delhi, 2009.
4. Steven S. Muchnick, "Advanced Compiler Design Implementation", First Edition Elsevier Science India, Morgan Kaufmann Publishers, 2008

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand the phases of compiler and recognize tokens from language specifications	3			1	3										
CO2	Create framework for syntax directed translation schemes, and parse the generated tokens.	3		1	1		2				3					
CO3	Construct the intermediate code representation and generation	3			1		2		3		2					
CO4	Develop a simple compiler by using different compiler construction tools	3	2	1	1	3	2		2		2					
CO5	Apply the optimization technique to generated optimized code	3			1	3	2									

L	T	P	C
3	0	0	3

PREREQUISITES: Object Oriented Programming, Java Programming,

OBJECTIVES

- To provide an overview of working principles of internet, web related functionalities.
- To understand and practice embedded dynamic scripting on client side Internet Programming.
- To understand and apply the fundamentals core java, packages, database connectivity for computing.
- To acquire the knowledge on server side programming.
- To develop web services using AJAX.

UNIT I   INTRODUCTION   9

Internet Standards – Introduction to WWW – WWW Architecture - Overview of HTTP, HTTP request – response – Generation of dynamic web pages. Web 2.0: Basics, Rich Internet Applications, Collaboration tools. UI DESIGN: Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts –Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames -HTML Forms. Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds – Manipulating text - Margins and Padding - Positioning using CSS

UNIT II   JAVASCRIPT, JQUERY   9

Introduction to JavaScript - Syntax - Variables and data types - JavaScript Control Statements - Operators - Literals - Functions - Objects - Arrays - Built in objects - Event handling - Fundamentals of JQuery - JQuery selectors - JQuery methods to access HTML attributes - Traversing - Manipulators - Events – Effects.

UNIT III   DOM,XML   9

Introduction to the Document Object Model - DOM History and Levels - Intrinsic Event Handling - Modifying Element Style - The Document Tree - Properties of window - DOM Collections - Using Timer and Dynamic Styles to Create Animated Effects.XML – Introduction-Form Navigation-XML Documents- XSL – XSLT.

UNIT-IV   SERVER SIDE PROGRAMMING   9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Multi– tire application Installing and Configuring Apache Tomcat Web Server DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

UNIT V   INTRODUCTION TO AJAX AND WEB SERVICES   9

AJAX: Client Server Architecture-XML Http Request Object-Call Back Methods. Introduction to Web Services: UDDI, SOAP, WSDL, Service Provider, Service Consumer, Web Service Architecture,Case Study: Developing and deploying web services.

TOTAL HOURS: 45

COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1: Acquire knowledge about functionalities of World Wide Web.
CO2: Explore markup languages features and create interactive web pages using them.
CO3: Design Client side validation using scripting languages.
CO4: Design web page and connect to the databases.
CO5: Create, describe, publish and consume the Web Services.

TEXT BOOKS
1. Harvey M. Deitel and Paul J.Deitel, Internet & World Wide Web How to Program, Pearson Education, 2018.
2. Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson Education, 2008.

REFERENCE BOOKS
1. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, Fourth Edition, 2007.
2. Kogent Learning Solutions Inc., "Html5 Black Book: Covers CSS3, JavaScript, XKL,XHTML, AJAX,PHP and jQuery", Dreamtech Press, 2011.
3. Joe Fawcett, Danny Ayers, Liam R. E. Quin, "Beginning XML", John Wiley & Sons Publisher, FifthEdition, 2012
4. Achyut S Godbole and AtulKahate, "Web Technologies", Second Edition, Tata McGraw Hill,2012.
5. Bates, "Developing Web Applications", Wiley, 2006.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Acquire knowledge about functionalities of World Wide Web.	3		1	2	2	3									
CO2	Explore markup languages features and create interactive web pages using them.	3				2	2				3					
CO3	Design Client side validation using scripting languages.	3		1		1						2	3			
CO4	Design web page and connect to the databases.	3	2		2	2	1						2			
CO5	Create, describe, publish and consume the Web Services.	3			2	2										

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		L	T	P	C
618CST05	**ARTIFICIAL INTELLIGENCE**	3	0	0	3

PREREQUISITES: NIL

OBJECTIVE(S):

- Understand the Characteristics of Intelligent Agents
- Solve problems using various Search Strategies & Knowledge Representation Scheme
- Realize the various applications of AI

UNIT– I   INTRODUCTION   8

Introduction – Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

UNIT– II   PROBLEM SOLVING METHODS   10

Problem solving Methods - Search Strategies: Uninformed - Informed - Heuristics- Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation -Backtracking Search - Game Playing -Optimal Decisions in Games - Alpha—Beta Pruning -Stochastic Games

UNIT– III   KNOWLEDGE REPRESENTATION   10

Propositional Logic - First Order Logic: Syntax and Semantics – Extensions & Notational variations –Using First Order Logic – Logical agents of Wumpus world - Knowledge Engineering – General ontology Inference in First order Logic: Inference Rules involving quantifiers – Forward and Backward Chaining Resolution – Completeness of Resolution.

UNIT– IV   PLANNING & LEARNING   9

Planning: A simple Planning Agent – Basic Representations for Planning – Partial Order planning Example – Partial Order Planning Algorithm. Learning: Inductive Learning – Learning Decision Trees – Learning in Neural and Belief Networks: Neural networks – Perceptrons – Multilayer Feed-Forward networks.

UNIT– V   AI APPLICATIONS   8

AI Applications – Language models – Information Retrieval – Information Extraction – Natural Language Processing – Machine Translation – Robot – Hardware Perception – Planning – Moving. **CASE STUDY: Speech Recognition.**

TOTAL: 45 HOURS

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Understand various problem solving approaches for AI problems.

CO2: Apply different search strategies and heuristics in problem solving.

CO3: Utilize various Knowledge Representation Techniques in solving complex real-life problems.

CO4: Understand the concepts of Planning and Learning Techniques.

CO5: Build new applications for real-world scenarios.

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig," Artificial Intelligence - A Modern Approach", ThirdEdition, Prentice Hall of India/ Pearson Education, New Delhi, 2015.

REFERENCE BOOKS:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones andBarlett Publishers, Inc., First Edition 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISOStandard", Fifth edition, Springer, 2003.
4. Eaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition,Tata McGraw-Hill Education, 2008.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand various problem solving approaches for AI problems.	3			1	2	3	2								
CO2	Apply different search strategies and heuristics in problem solving.	3		1	1											
CO3	Utilize various Knowledge Representation Techniques in solving complex real-life problems.	3	2		1						3					
CO4	Understand the concepts of Planning and Learning Techniques.	3			1	2		2			2					
CO5	Build new applications for real-world scenarios.	3			1	2	2	2			2					

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OBJECTIVE(S):

The student should be made to:

- Know the components and structure of mobile application development frameworks for Androidand windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Can able to draw basic graphical primitive on the mobile application and GPS location tracking information.

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multithreading
8. Develop a native application that uses GPS location information.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that creates alarm clock

TOTAL: 45 HOURS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Design and Implement various mobile applications using emulators.

CO2: Deploy applications to hand-held devices

CO3: Develop an application using basic graphical primitives and databases.

CO4: Construct an application using multi threading and RSS feed and Make useof location identification using GPS in an application.

LIST OF EQUIPMENTS:

- Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development
- Tools with appropriate emulators and debuggers.

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Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design and Implement various mobile applications using emulators	3		1	3	1	3	2	3	2						
CO2	Deploy applications to hand-held devices	3				1		2	2	2						
CO3	Develop an application using basic graphical primitives and databases.	3	2		3	1	2	2	1							
CO4	Construct an application using multi threading and RSS feed and Make useof location identification using GPS in an application.	3			2	1	3	2		1						

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L	T	P	C
0	0	2	1

OBJECTIVES:

1. Learn how to build a data warehouse and query it.

2. Understand the data sets and data pre-processing.

3. Demonstrate the working of algorithms for data mining tasks such association rule mining, Classification, clustering and regression.

4. To obtain Practical experience with all real data sets.

LIST OF EXPERIMENTS:

1. Build Data Warehouse and Explore WEKA

2. Implement preprocessing on dataset student.arff

3. Implement association rule mining on data sets

4. Implement Association rule process on dataset test.arff using apriori algorithm

5. Implement classification rule process on dataset employee.arff using naïve Bayes algorithm

6. Implement clustering rule process on dataset student.arff using simple k-means

7. Implement classification on data sets

8. Implement clustering on data sets

9. Implement Regression on data sets

10. Credit Risk Assessment using German Credit Data

11. Implementation of ERP.

COURSE OUTCOMES:

At the end of the course students can able to;

CO1: Understand and create data

CO2: Implement the association rule, classification and clustering in large data sets.

CO3: Add mining algorithms as a component to the exiting tools.

CO4: Apply mining techniques for realistic data.

CO5: Apply data mining techniques in real world data analysis.

LAB REQUIREMENTS:
SOFTWARE   : WEKA, Python Libraries
HARDWARE   : Standalone desktops

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Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 : Understand and create data	3			1	3	1		2		1					
CO2 Implement the association rule, classification and clustering in large data sets.	3		1	1	1	1				1					
CO3 Add mining algorithms as a component to the exiting tools.	3	2		1	2					1					
CO4 Apply mining techniques for realistic data..	3			1	2				3	1					
CO5 Apply data mining techniques in real world data analysis.	3			1	2	3				1					

COURSE OBJECTIVES

- Be familiar with Web page design using HTML / DHTML and style sheets
- Use JavaScript to access and use web services for dynamic content
- Learn to create dynamic web pages using server side scripting.

LIST OF EXPERIMENTS

1. a)Design a web pages for your college containing a description of the courses, departments, faculties, library, etc (use href, list, frame tags)

    b)Create your class timetable using table tag.

2. Design a web page of your home town with an attractive background color, textcolor, animage, font.(use External, Internal, and Inline CSS to format)

3. Create a Student registration form for job application and validate the form fields using JavaScript.

4. Create a Quiz program with adaptive questions using JavaScript.

5. Create an online Event Registration form and validate using Jquery.

6. With the help of JDBC Connectivity to get details of bank customers transactions (credits and debits).Write a JSP to calculate the current balance, cumulative total of credits and debits of the individual customer.

7. Create an Extensible mark up language to represent the students mark information of a class. Create a webpage to display all the students consolidated mark statement with pass (green color)or fail (red color)using XSLT

8. Develop a web service for an airline management and implement the following scenariousing database

    (a) Check ticket availability.

    (b) Check air services through travel agent.

    (c) Search a passenger whether he / she travelled in a particular date ornot.

9. Create a program to change the content of the web page using AJAX.

TOTAL HOURS: 45

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COURSE OUTCOMES

At the end of the course, the student should be able to:

CO1: Design Web pages using HTML/DHTML and style sheets
CO2: Create dynamic web pages using server side scripting.
CO3: Design and Implement database applications.
CO4: Develop the simple GUI interfaces to interact with users and real time applications.

SOFTWARE REQUIREMENTS

Operating System: Linux / Windows
Programming Language & IDE: HTML 5, JDK 1.7, Coffee Cup Editor, PHP, Notepad++.Server:
Apache Tomcat Server / XAMP / LAMP
Backend: MYSQL / SQLlite

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Design Web pages using HTML/DHTML and style sheets	3		1	3	1	3	2	3	2						
CO2 Create dynamic web pages using server side scripting.	3	2			1		2	2	2						
CO3 Design and Implement database applications.	3		1	3	1	2	2	1							
CO4 Develop the simple GUI interfaces to interact with users and real time applications	3			2	1	3	2		1						

	L	T	P	C
618CIE01 **MULTICORE ARCHITECTURE**	3	0	0	3

PREREQUISITES: Computer Architecture

OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To expose the students to warehouse-scale and embedded architectures

UNIT I   FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS   9

Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of ComputerDesign – Classes of Parallelism - ILP, DLP, TLP and RLP - Multithreading - SMT and CMPArchitectures – Limitations of Single Core Processors - The Multicore era – Case Studies of Multicore Architectures.

UNIT II   DLP IN VECTOR, SIMD AND GPU ARCHITECTURES   9

Vector Architecture - SIMD Instruction Set Extensions for Multimedia – Graphics ProcessingUnits- Detecting and Enhancing Loop Level Parallelism - Case Studies.

UNIT III   TLP AND MULTIPROCESSORS   9

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues - Performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV   RLP AND DLP IN WAREHOUSE-SCALE ARCHITECTURES   9

Programming Models and Workloads for Warehouse-Scale Computers – Architectures for Warehouse-Scale Computing – Physical Infrastructure and Costs – Cloud Computing – Case Studies.

UNIT V ARCHITECTURES FOR EMBEDDED SYSTEMS   9

Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – The Digital Signal Processor – Embedded Multiprocessors - Case Studies.

TOTAL HOURS: 45 HOURS

COURSE OUTCOMES
At the end of the course the students should be able to

CO1: Identify the limitations of ILP and the need for multicore architectures
CO2 Discuss the issues related to multiprocessing and suggest solutions
CO3: Understand the salient features of different multicore architectures and how they exploit parallelism
CO4: Critically analyze the different types of inter connection networks
CO5: Understand the architecture of GPUs, warehouse-scale computers and embedded processors

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TEXT BOOK

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.

REFERENCES

1. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill Education, 2003
2. Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", PrenticeHall, 2011.
3. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A Hardware/ SoftwareApproach" , Morgan Kaufmann / Elsevier, 1997.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Identify the limitations of ILP and the need for multicore architectures	3			3	3										
CO2	Discuss the issues related to multiprocessing and suggest solutions	3		1	3	2					3					
CO3	Understand the salient features of different multicore architectures and how they exploit parallelism	3		2				3	1		3					
CO4	Critically analyze the different types of inter connection networks	3	2					2	3		2					
CO5	Understand the architecture of GPUs, warehouse-scale computers and embedded processors	3		1		3			2							

		L	T	P	C
618CSE02	**PARALLEL AND DISTRIBUTED COMPUTING**	3	0	0	3

PREREQUISITES: Design and Analysis of Algorithm, ComputerNetworks, Operating System, Computer Organization and Architecture

OBJECTIVES
- To understand the need and fundamentals of parallel and distributed computing paradigms.
- To learn the about the scheduling, decomposition techniques and its mapping.
- To build application using remote procedure call
- To utilize and manage the resources in a distributed computing environment
- To explore knowledge in distributed file systems.

UNIT I   INTRODUCTION TO PARALLEL COMPUTING   9
Parallel Processing Terminology - Scope of Parallel Computing-**Parallel Computer Memory Architectures** -The PRAM model of Parallel Computation - PRAM Algorithms - Parallel reduction - Prefix Sum - List Ranking - Preorder Tree Traversal - Merging Two Sorted List - Graph Coloring.- **Nvidia CUDA programming model**

UNIT II   DESIGNING PARALLEL PROGRAMS AND MAPPING   9
Decomposition Techniques - Characteristics of Tasks and Interactions- Mapping Techniques for Load Balancing-collective communication-synchronization- OpenMP: a Standard for Directive Based Parallel Programming- Sorting Networks - Bubble Sort Variations – Discrete Optimization Problems:Parallel Depth First Search

UNIT III   DISTRIBUTED COMPUTING PARADIGM   9
Introduction to Distributed Computing System - Distributed Computing System Models - Distributed Operating System - Issues in Designing a Distributed Operating System - Introduction to Distributed Computing Environment(DCE) - Network Types - Communication Protocols – Internetworking- **Election Algorithms: The Bully Algorithm- The Ring Algorithm-Case Study:RAY-Distributed Computing Framework**

UNIT IV   MESSAGE PASSING AND RESOURCE MANAGEMENT   9
Issues in IPC by message passing - Multi Datagram Messages - Encoding and Decoding of Message Data - Group Communication - The RPC Model - Transparency of RPC - Implementing RPC mechanism - Stub Generation - RPC Messages - Communication Protocols for RPCs - Client-Server Binding –**Resource Management:Features of a good scheduling algorithm-Task assignment approach-Load balancing-load sharing approach- Case study:MPI Remote Method Invocation And Object**

UNIT V   DISTRIBUTED FILE SYSTEM   9

Distributed File Systems-Desirable Features of a Good Distributed File System -File Models -File Replication -Fault Tolerance -Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions - Atomic Commit protocols - Concurrency Control in Distributed Transactions-- **Case Study:Open Source Distributed File Systems**

TOTAL HOURS: 45 HOURS

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1:   Apply parallel programming algorithms for real world problems.
CO2:   Acquire knowledge on different scheduling, decomposition techniques and its mapping.
CO3:   Develop applications by incorporating distributed computing architectures.
CO4:   Build remote procedure calls and manage resources
CO5:   Implement and deploy the application using distributed file systems

TEXT BOOK

1. Michael Quinn, "Parallel Computing - Theory and Practice", Second Edition, Tata McGraw Hill, 2012.
2. Distributed Operating System: Concepts and Design, Pradeep K. Sinha, PHI , 2012.

REFERENCES

1. Ananth Grama, Anshul Gupta, George Karypis andVipin Kumar, "Introduction to Parallel Computing", Second Edition, Pearson Education, 2009.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems, Conceptsand Design, Perason Education, 3rd Edition 2011.
3. Haggit Attiya and Jennifer Welch, "Distributed Computing - Fundamentals, Simulations and Advanced Topics", Second Edition, Wiley, 2012.
4. Norman Matloff, "Parallel Computing for Data Science -With Examples in R, C++and CUDA", Chapman and Hall/CRC, 2015.
5. Wan Fokkink, "Distributed Algorithms: An Intuitive Approach", MIT Press, 2013.
6. M.L. Liu, "Distributed Computing -Principles and Applications", First Edition, Pearson Education, 2011.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Apply parallel programming algorithms for real world problems..	3			3	3										
CO2 Acquire knowledge on different scheduling, decomposition techniques and its mapping.	3	2		3	2		3								
CO3 Develop applications by incorporating distributed computing architectures	3		1	3				1				3			
CO4 Build remote procedure calls and manage resources	3			3				2	3			3			
CO5 Implement and deploy the application using distributed file systems	3			3	3					2					

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		L	T	P	C
618MAE03/618MAO01	APPLIED STATISTICS AND NUMERICAL METHODS	3	1	0	4

**(Professional Elective for Computer Science and Engineering and
Open Elective Information Technology– Regulation 2018)**

Course Objectives
- To learn the basic concepts of statistics.
- To introduce the notion of sampling distributions and acquire the knowledge of statistical techniqueuseful in decision making.
- To expose the statistical methods for analysis of variance and control limits.
- To solve equations using direct and iterative methods.
- To introduce interpolation techniques and to study the principles of numerical differentiation andnumerical integration.

9 + 3

UNIT I   DESCRIPTIVE STATISTICS
Measures of Central tendency - Arthimetic Mean, Median, Mode - Measures of dispersion- Standard deviation and Variance – Graphical representation of data- Pie chart, Bar graph, Histogram and Ogives. Curve fitting by the Principle of least squares.

9 + 3

UNIT II   TESTING OF HYPOTHESIS
Sampling distributions – Testing of hypothesis for large samples by Z-test and small samples by Student's t-test for single Mean, Proportion, equality of means and equality of proportions – F-test for single variance and equality of variances – Chi-square test for Goodness of fit and Independence of attributes.

9 + 3

UNIT III   DESIGN OF EXPERIMENTS
ANOVA(Analysis of variance) – Completely Randomized Design(CRD-one way classification) – Randomised Block Design (RBD-two way classification) - Latin Square Design (LSD-Three way classification)- Control charts for measurements -$\bar{x}$ chart, R-chart

9 + 3

UNIT IV   NUMERICAL SOLUTION OF EQUATIONS
Solution of algebraic and transcendental equations : Fixed point iteration - Newton-Raphson method- Solution of system of equations - Direct Methods: Gauss Elimination method, Gauss-Jordan method, LU decomposition method and Cholesky decomposition method – Iterative methods: Gauss- Jacobi method and Gauss-Seidel method.

9 + 3

UNIT V INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION
Interpolation: Newton's forward and backward differences interpolation - Lagrange's and Newton's divided difference interpolation - Numerical differentiation using Newton's forward and backward difference interpolation - Numerical integration using Trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Total no. of periods: 45 + 15 = 60

Note: Use of approved statistical table is permitted in the examination.

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Course Outcomes

At the end of the course the student will be able to

CO 1: Apply the basic Statistical measures of Central Tendency and Dispersion and represent statisticaldata graphically for analysis.

CO 2: Draw conclusions through hypothesis testing.

CO 3: Acquaint with the knowledge of analysis of variance for decision making and analyse the controllimits of a sample.

CO 4: Apply numerical methods for solving algebraic ,transcendental equations and system of equationsby direct and iterative methods.

CO 5: Appreciate numerical techniques such as interpolation applied to find derivatives and numericalintegration.

TEXT BOOKS

1. Gupta.S.C., & Kapoor,V.K., "Fundamentals of mathematical statistics", 11th edition, SultanChand & Sons publishers, New Delhi, 2013.
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition,Khanna Publishers, New Delhi, 2004.

REFERENCES

1. Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishingcompany Limited, New Delhi, 2014.
2. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers andScientists", Pearson Education, Asia , 8th edition, 2007.
3. Miller and Freund., "Probability and Statistics for Engineers", Pearson Education, Asia, 7thedition, 2012.
4. Kandasamy.P, Thilagavathy,K. & Gunavathi.K., "Numerical Methods"., S.Chand & CompanyLtd., New Delhi, 2014.
5. S.S.Sastry, "Introductory Methods of Numerical Analysis", 5th Edition, Prentice Hall of IndiaPrivate Ltd., New Delhi, 2012.

Course Outcomes		PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Apply the basic Statistical measures of Central Tendency and Dispersion and represent statisticaldata graphically for analysis.	3			3	3										1
CO2	Draw conclusions through hypothesis testing.	3			3	3	2	3								2
CO3	Acquaint with the knowledge of analysis of variance for decision making and analyse the controllimits of a sample.	3		1	3	3	2	3								2
CO4	Apply numerical methods for solving algebraic ,transcendental equations and system of equationsby direct and iterative methods.	3			3	3	2	2								2
CO5	Appreciate numerical techniques such as interpolation applied to find derivatives and numerical integration.	3	2		3	3	2	2								

	L	T	P	C
618CSE04 NETWORK DESIGN AND MANAGEMENT	3	0	0	3

Prerequisite: Computer Networks

OBJECTIVE(S):

- To understand the concepts and terminology associated with SNMP and TMN
- To learn to the concepts and architecture behind standards based network management
- To understand the need for interoperable network management
- To understand network management as a typical distributed application
- To study the current trends in network management technologies

UNIT I - PHYSICAL NETWORK DESIGN 9

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches –Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

UNIT II - OSI NETWORK MANAGEMENT 9

Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network. OSI Network management model - Organizational model - Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

UNIT III - INTERNET MANAGEMENT(SNMP) 9

SNMP (V1 and V2) - Organizational model - System Overview, The information model, communication model - Functional model, SNMP proxy server, Management information, protocol remote monitoring - RMON SMI and MIB, RMON1, RMON2 - A Case Study of Internet Traffic Using RMON.

UNIT IV - BROADBAND NETWORK MANAGEMENT 9

Broadband networks and services, ATM Technology - VP,VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN. ATM Network Management - ATM Network reference model, integrated local management Interface. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management - TMN conceptual Model - TMN Architecture, TMN Management Service Architecture

UNIT V - NETWORK MANAGEMENT APPLICATIONS 9

Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management - Network Management Tools, Network Statistics Measurement Systems – Web Based Management, XML Based Network Management - : Future Directions.

TOTAL: 45 HOURS

COURSE OUTCOMES:

At the end of the course, the student should be able to: CO1:

Apply the networking principles to design a network

CO2: Formulate possible approaches for managing OSI network model.

CO3: Use on SNMP for managing the network & RMON for monitoring the behavior of the Network

CO4: Explore the possibilities of improving the speed of the network and managing them

CO5: Identify the various components of network and formulate the scheme for themanaging them

TEXT BOOKS:

1. Mani Subramanian, "Network Management Principles and practice ", Pearson Education,New Delhi, 2010.

2. STALLINGS, WILLIAM, "SNMP, SNMPv2, SNMPv3, and RMON 1 and 2," Pearson Education, 2012

REFERENCE BOOKS:

1. Salah Aiidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.

2. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi, 1999.

Course Outcomes	PSo1	PSO2	PSO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Apply the networking principles to design a network	3			3	3										
CO2 Formulate possible approaches for managing OSI network model.	3		1	3	3					2					
CO3 Use on SNMP for managing the network & RMON for monitoring the behavior of the Network	3	2					3			2	1				
CO4 Explore the possibilities of improving the speed of the network and managing them .	3		1				3		3	2	2				
CO5 Identify the various components of network and formulate the scheme for the managing them	3			3	1			2			3				

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Prerequisite: Computer Networks

OBJECTIVES

- Learn the fundamentals of Cryptography.
- Comprehend the Mathematical Foundations of Security Principles.
- Describe the principles of Public Key Cryptosystem, Hash Function, Key Management and Internet Security.
- Gain knowledge about Security in Network and Program.

UNIT - I   SYMMETRIC KEY ENCRYPTION   **9**

Overview - Classical Encryption Techniques - Block Ciphers and Data Encryption Standard - Block Cipher Operations - Advanced Encryption Standard: AES Structure, AES Transformation Function.

UNIT - II   NUMBER THEORY AND PUBLIC KEY ENCRYPTION   **10**

Basic Concepts in Number Theory: The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms - Public Key Cryptography and RSA - Cryptographic Hash Functions: Applications, Secure Hash Algorithm (SHA) - Digital Signature Overview.

UNIT - III   KEY MANAGEMENT AND INTERNET SECURITY   **8**

Key Management and Distribution - Authentication Applications: Kerberos - Electronic Mail Security: PGP, IP Security Overview.

UNIT - IV   SECURITY IN NETWORKS   **9**

Threats in Networks - Firewalls: Design, Types, and Configuration -Intrusion Detection System: Types, Goals, Strengths and Limitations, Snort.

UNIT - V   PROGRAM SECURITY   **9**

Secure Programs - Nonmalicious Program Errors - Viruses and other Malicious Code - Targeted Malicious Code - Control against Program Threats.

TOTAL: 45

COURSE OUTCOMES

At the end of the course the students are able to,

CO1:   Apply Cryptographic Algorithms for Secure Data Transmission.
CO2:   Understand the Mathematical aspects behind Security.
CO3:   Apply Key Management and Authentication Techniques to provide Secure Communication.
CO4:   Understand the importance of Firewalls and Intrusion Detection System.
CO5:   Discover and identify abnormalities within the Network caused by Worms, Viruses and Program threats.

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TEXT BOOKS

1. William Stallings, "Cryptography and Network Security, Sixth Edition, Prentice Hall, New Delhi, 2014.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing" Fifth Edition, Prentice Hall, 2015.

REFERENCE BOOKS

1. Behrouz A Forouzan, "Cryptography and Network Security", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
2. Atul Kahate,"Cryptography and Network Security", Third Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

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715CIT02   DATA WAREHOUSING AND DATA MINING

L T P C
3 0 0 3

OBJECTIVE(S):
- To make familiar with the various concepts of data warehouse architecture, Online Analytical Processing (OLAP), Meta data, Data mart, and multidimensional data models.
- To sail along with the various approaches in data mining.
- To familiarize with data mining algorithms and its application in various fields.

Prerequisite: Database Management Systems

UNIT-I   DATA WAREHOUSE & OLAP TECHNOLOGY   9
Data Warehouse Overview - Multidimensional Data Model - Data Warehouse Architecture - Data Warehouse Implementation - Data Warehousing to Data Mining.

UNIT-II   DATA MINING   9
Introduction - Kinds of data - Data Mining Functionalities - Interestingness of Patterns - Classification of Data Mining Systems - Data Mining Task Primitives - Integration of a Data Mining System with a Data Warehouse - Issues - Data Preprocessing.

UNIT-III ASSOCIATION RULE MINING   9
Mining Frequent Patterns- Associations and Correlations - Frequent item set Mining Methods – Mining Various Kinds of Association Rules - Correlation Analysis - Constraint Based Association Mining.

UNIT- IV   CLASSIFICATION   9
Basic Concepts - Classification and Prediction - Issues - Decision Tree Induction – Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines – Associative Classification - Prediction.

UNIT-V   CLUSTERING AND APPLICATIONS AND TRENDS IN DATA MINING   9
Cluster Analysis - Types of Data - Categorization of Major Clustering Methods – k-Means - Partitioning Methods - Hierarchical Methods - Density-Based Methods - Grid Based Methods - Model-Based Clustering Methods - Clustering High Dimensional Data - Constraint – Based Cluster Analysis - Outlier Analysis - Data Mining Applications - Trends in Data Mining - Case study :   DBMiner , WEKA Tool.

TOTAL: 45

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Have an extensive knowledge on concepts of data warehousing and differentiate OLTP and OLAP.
CO2: Discover and measure interesting patterns from different kinds of databases.
CO3: Apply the technique of association finding to solve real life problems.
CO4: Compare and contrast the various classifiers.
CO5: Able to explore recent trends in data mining and its applications.

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TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, 2007.

REFERENCES BOOKS:

1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction To Data Mining", Pearson Education, 2007.
3. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.

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15CIT03   MOBILE APPLICATION DEVELOPMENT

L T P C
3 0 0 3

OBJECTIVE(S):

- To learn the characteristics of mobile applications.
- To learn about the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

Prerequisites: Java Programming

UNIT –I   GETTING STARTED WITH MOBILITY   9

Mobility landscape, Mobile platforms – Apple iPhone Platform- Google Android Platform – Eclipse Simulator, Mobile apps development, setting up the mobile app development environment along with an emulator - Case Study on Mobile App development.

UNIT-II   BUILDING BLOCKS OF MOBILE APPS – I   9

App user interface designing – mobile UI resources (Layout, UI elements, Drawable Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, ASync task, Services – states and lifecycle, Notifications.

UNIT-III   BUILDING BLOCKS OF MOBILE APPS – II   9

Broadcast receivers, Telephony and SMS APIs , Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)

UNIT-IV   SPRUCING UP MOBILE APPS   9

Graphics and animation – custom views, canvas, animation APIs, multimedia – Audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)

UNIT-V   TESTING MOBILE APPS AND TAKING APPS TO MARKET   9

Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk, Versioning, signing and packaging mobile apps, distributing apps on mobile market place.

TOTAL: 45

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COURSE OUTCOMES:

At the end of the course students should be able to

    CO1: Familiarize with Mobile apps development aspects.

    CO2: Design and implement the user interfaces for mobile applications

    CO3: Develop useful mobile applications using Google Android and Eclipse simulator.

    CO4: Develop mobile applications using graphics and animation

    CO5: Perform testing, signing, packaging and distribution of mobile apps

TEXT BOOK:

1. Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition,

   Wiley India, (2013)

REFERENCE BOOKS:

1. Barry Burd , "Android Application Development All in one for Dummies", First   Edition , Wiley India ,(2011)

2. Lauren Darcey , Shane Conder, "Teach Yourself Android Application Development In 24 Hours", Second Edition, Wiley India , (2012)

OBJECTIVES:
- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To be able to set up a private cloud.

UNIT-I   INTRODUCTION   8

Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack.

UNIT-II   VIRTUALIZATION   9

Data Center Technology - Virtualization - Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization - Implementation Levels of Virtualization - Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V.

UNIT-III   CLOUD COMPUTING MECHANISM   9

Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT-IV   HADOOP AND MAP REDUCE   10

Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/O- Developing a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features– Hadoop Cluster Setup – Administering Hadoop.

UNIT-V   SECURITY IN THE CLOUD   9

Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images

TOTAL: 45

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2: Choose the appropriate technologies, algorithms and approaches for the related issues in cloud.

CO3: Identify the architecture, infrastructure and delivery models of cloud computing.

CO4: Understand and apply Map and Reduce Programming.

CO5: Understand the core issues of cloud computing such as security, privacy and interoperability.

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TEXT BOOK:

1. Thomas Erl, Zaigham Mahood, Ricardo uttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, 2013.

REFERENCE BOOKS:

1. Toby Velte, Anthony Velte, Robert C. Elsenpeter, - Cloud Computing, A Practical Approach Tata McGraw-Hill Edition, 2010.
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, - Mastering Cloud Computing, Tata McGraw-Hill, 2013.
3. Arshdeep Bahga, Vijay Madisetti, - Cloud Computing: A Hands- On Approach , Universities Press, 2014.
4. Tom White, - Hadoop: The Definitive Guide, O'Reilly Media, 4th Edition, 2015.
5. James E Smith and Ravi Nair, -Virtual Machines, Elsevier, 2005.
6. John Rittinghouse and James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.

OBJECTIVE(S):

The student should be made to:

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Can able to draw basic graphical primitive on the mobile application.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand how to work with GPS location tracking information.

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multithreading
8. Develop a native application that uses GPS location information.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that creates alarm clock

TOTAL: 45 COURSE

OUTCOMES:

At the end of the course, the student should be able to:

    CO1: Design and Implement various mobile applications using emulators. **CO2:**
    Deploy applications to hand-held devices

    CO3: Develop an application using basic graphical primitives and databases.

    CO4: Construct an application using multi threading and RSS feed and Make use of
         location identification using GPS in an application.

LIST OF EQUIPMENTS:

- Standalone desktops with Windows or Android or iOS or
  Equivalent Mobile Application Development
- Tools with appropriate emulators and debuggers.

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OBJECTIVE(S):

- Building and design of the foundational enterprise IT architecture
- To evolving technology, continued improvements in enterprise applications and establishing baseline metrics is important to the sustenance of key infrastructure elements of software enterprise applications
- A Unified meta-model of elements can lead to effective business analysis from an idea that originated in order to bring rigid engineering concepts to building enterprise IT systems, Enterprise Architecture (EA) is evolving into a business-driven
- To formally capture and implement the dynamic and static elements of an enterprise to manage enterprise change

UNIT I INTRODUCTION   8

Introduction to Enterprise Applications and their Types, Software Engineering Methodologies, Life Cycle of Raising an Enterprise Application, Introduction to Skills Required to Build an Enterprise Application, Key Determinants of Successful Enterprise Applications, and Measuring the Success of Enterprise Applications.

UNIT II INCEPTING ENTERPRISE APPLICATIONS   9

Inception of Enterprise Applications, Enterprise Analysis, Business Modeling, Requirements Elicitation, Use Case Modeling, Prototyping, Non Functional Requirements, Requirements Validation, Planning and Estimation.

UNIT III ARCHITECTING AND DESIGNING ENTERPRISE APPLICATIONS   10

Concept of Architecture, Views and Viewpoints, Enterprise Architecture, Logical Architecture, Technical Architecture - Design, Different Technical Layers, Best Practices, Data Architecture and Design – Relational, XML, and Other Structured Data Representations, Infrastructure Architecture and Design Elements - Networking, Internetworking, and Communication Protocols, IT Hardware and Software, Middleware, Policies for Infrastructure Management, Deployment Strategy, Documentation of Application Architecture and Design.

UNIT IV CONSTRUCTING ENTERPRISE APPLICATIONS   9

Construction Readiness of Enterprise Applications - Defining a Construction Plan, Defining a Package Structure, Setting up a Configuration Management Plan, Setting up a Development Environment, Introduction to the Concept of Software Construction Maps, Construction of Technical Solutions Layers, Methodologies of Code Review, Static Code Analysis, Build and Testing, Dynamic Code Analysis – Code Profiling and Code Coverage.

Types and Methods of Testing an Enterprise Application, Testing Levels and Approaches, Testing Environments, Integration Testing, Performance Testing, Penetration Testing, Usability Testing, Globalization Testing and Interface Testing, User Acceptance Testing, Rolling out an Enterprise Application.

Total 45 Hrs

TEXT BOOK

1. Raising Enterprise Applications: A Software Engineering Perspective, Anubhav Pradhan Satheesha B. Nanjappa Senthil K. Nallasamy Veerakumar Esakimuthu, 1st Edition, Wiley India Pvt Ltd, 2010, ISBN:9788126519460.

REFERENCE BOOKS

1. Raffaele Garofalo, "Building Enterprise Applications with Windows Presentation Foundation and the Model View ViewModel Pattern", 1st Edition, Microsoft Press, 2011

2. Dominic Duggan, "Enterprise Software Architecture and Design Entities, Services, and Resources", 1st Edition, Wiley India Pvt Ltd, 2012

3. Martin Fowler, "Patterns of Enterprise Application Architecture", 1st Edition, Pearson/ Goels Computer Hut Publisher,

715CSE03	**BUSINESS INTELLIGENCE AND ITS APPLICATIONS**	L T P C
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OBJECTIVE(S):

- To Understand the BI concept and frame work
- To Understand Transaction Processing and Analytical applications and describe the need for Business Intelligence
- To identify the metrics, indicators and make recommendations to achieve the business goal

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE 9

Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices

UNIT II BASICS OF DATA INTEGRATION (EXTRACTION TRANSFORMATION LOADING) 9

Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).

UNIT III INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING 9

Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using Microsoft Excel

UNIT IV BASICS OF ENTERPRISE REPORTING 9

A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.

UNIT IV BI AND MOBILITY 9

Understanding BI and Mobiltiy,BI and Cloud Computing, Business Intelligence for ERP systems, Social CRM and BI,Case Study-Good Food Restaurants, TenTo Ten Retails stores.

Total 45 Hrs

TEXT BOOKS

1. Business Intelligence by David Loshin
2. Business intelligence for the enterprise by Mike Biere.
3. Fundamentals of Business Analytics by R.N.Prasad And Seema Acharya Wiley India,2011.

REFERENCE BOOKS

1. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre
2. An introduction to Building the Data Warehouse – IBM
3. Business Intelligence For Dummies – Swain Scheps
4. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson
5. Information dashboard design by Stephen Few

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OBJECTIVE(S):

- Understand logical and physical components of a storage infrastructure
- To study different types of storage area networks
- To gain knowledge in different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities
- To gain knowledge in information security and identify different storage virtualization technologies

Pre requisites: Computer Networks, Database Systems

UNIT I   INTRODUCTION TO STORAGE TECHNOLOGY   9

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities.

UNIT II   STORAGE SYSTEMS ARCHITECTURE   9

Hardware and software components of the host environment, Key protocols and concepts used by each component, Physical and logical components of a connectivity environment , Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, RAID , RAID levels, Compare and contrast integrated and modular storage systems, High-level architecture and working of an intelligent storage system

UNIT III   INTRODUCTION TO NETWORKED STORAGE   9

Evolution of networked storage, Architecture, components, and topologies of FC -SAN, NAS, and IP-SAN, FCoE , iSCSI Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments.

UNIT IV   INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTER   9

Business Continuity- Information Availability, RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, Architecture of backup/recovery and the different backup/ recovery topologies, Data Deduplication, Local and Remote replication technologies. Monitoring the storage infrastructure, Information Life cycle Management.

UNIT V   SECURING STORAGE AND STORAGE VIRTUALIZATION   9

Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes.

TOTAL: 45

COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Ability to identify the key requirements of data center.

CO2: Analyze the different storage systems architecture.

CO3: Analyze different storage networking technologies.

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CO4: Ability to identify key challenges in managing information and also describe the different role in providing disaster recovery and business continuity capabilities.

CO5: Ability to identify and analyzes the common threats in different domains.

REFERENCE BOOKS:
1. EMC Corporation, Information Storage and Management, Wiley, India, 2nd Edition, 2012.
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, "Building Storage Networks", Tata McGraw Hill ,Osborne, 2001.

OBJECTIVE(S):

The student should be able to
- Know the basic Constructs of Agile Software Development
- Understand agile software development practices
- Demonstrate Agile development and testing techniques
- Know the benefits and pitfalls of working in an Agile team

UNIT-I FUNDAMENTALS OF AGILE   9

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

UNIT-II AGILE SCRUM FRAMEWORK   9

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

UNIT-III AGILE TESTING   8

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

UNIT-IV AGILE SOFTWARE DESIGN AND DEVELOPMENT   10

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

UNIT-V INDUSTRY TRENDS   9

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies

                                                                Total 45 Hrs

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COURSE OUTCOMES:

At the end the student will be able to

CO1: Understand Agile development using Test Driven Development

CO2: Understand the Agile Scrum framework.

CO3: Perform testing activities within an Agile project

CO4: Apply design principles and refactoring to achieve Agility

CO5: Deploy automated build tools, version control and continuous integration

TEXT BOOKS:

1. Agile Software Development with Scrum By Ken Schawber, Mike Beedle Pearson Publisher, 1st Edition, 2001.
2. Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory, Addison Wesley Publisher, 1st Edition, 2009.

REFERENCE BOOKS:

1. Agile Software Development, Principles, Patterns and Practices By Robert C. Martin, Prentice Hall Publisher, 1st Edition, 2006.
2. Agile Software Development: The Cooperative Game By Alistair Cockburn Addison Wesley Publisher, 2nd Edition, 2008.
3. User Stories Applied: For Agile Software By Mike Cohn Publisher: Addison Wesley, 1st Edition, 2004.

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715CSE07	Software Project Management	L T P C
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PREREQUISITE: Software Engineering

OBJECTIVE(S):

- To develop an awareness of the need for project planning and management
- To learn about the stages in the software development lifecycle and associated activities.
- To know about the procedures needed to schedule , monitor and control the project.
- Discuss and where appropriate apply the principles of project risk management.
- Understand the key concepts relating to managing projects.

UNIT-I FUNDAMENTALS 9

Conventional software management - Evolution of software economics - Improving software economics - Conventional Vs Modern Software Project Management.

UNIT-II SOFTWARE MANAGEMENT PROCESS FRAMEWORK 9

Lifecycle phases - Artifacts of the process - Model based software architectures -Workflows of the process - Checkpoints of the process.

UNIT-III SOFTWARE MANAGEMENT 9

Iterative Process Planning - Organization and Responsibilities - Process automation - Process control and process instrumentation - Tailoring the process.

UNIT-IVSOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING 9

Basics for Effort Estimation - Techniques - Expert judgment - Estimation by Analogy - Albrecht Function Point Analysis - COCOMO Cost Estimation Model – Activity planning –Objectives-Project schedules-Network planning models-Forward and Backward pass – Identifying the critical path.

UNIT-V SOFTWARE RISK AND RECENT TRENDS 9

Introduction - Categories - Risk Identification - Risk Assessment - Risk Planning Risk Management – Evaluating Risk – Agile Project Management – Scrum Case Study - Tools for Agile Project Management.

Total 45 Hrs

COURSE OUTCOMES:

At the end of the course, the students should be able to:

CO1: Understand about software Economics.

CO2: Analyzevarious software process models.

CO3: Acquire activity planning skills.

CO4: Apply software estimation techniques.

CO5: Acquire knowledge in Risk evaluation and agile methodologies.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.
2. Walker Royce," Software Project Management A Unified Framework", Pearson Education, 2004.
3. Ken Schawber, MikerBeedle, "Agile Software Development with Scrum", Pearson Education, 2008.

REFERENCE BOOKS:

1. RishabhAnand ,"Software Project Management" S.K. Kataria& Sons- 2013 .

2. S.A. Kelkar, "Software Project Management: A Concise Study Paperback ", Phi 2013.

3. Ramesh Gopalaswamy, - "Managing Global Software Projects", Tata McGraw Hill, 2001.

4. Humphrey Watts, "Managing the software process", Addison Wesley, 1989.

5. Ashfaque Ahmed "Software Project Management Process Driven Approach", Auerbach

   Publications, 2011.

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PREREQUISITES: Computer Networks

OBJECTIVE(S):
- Learn the architecture and design issues in Ad Hoc and Sensor Network.
- Familiarize different types of MAC protocols in Ad Hoc Networks.
- Know the fundamental of routing protocols in Ad Hoc Networks.
- Understand the basic concepts of WSN.
- Imparts knowledge of routing in WSN

UNIT I   INTRODUCTION   9
Fundamentals of Wireless Communication Technology – Ad Hoc and Sensor Network Concepts and Architecture – Characteristics of Ad Hoc and Sensor Network – Design Issues and Challenges in Ad Hoc and Sensor Network – Applications of Ad Hoc and Sensor Network - Cognitive Radio – Underwater Wireless Sensor Network.

UNIT II MAC PROTOCOLS FOR AD HOC NETWORKS   9
Classifications – Contention based Protocols: MACAW – MACA by Invitation. Contention based Protocols with Reservation Mechanism: Distributed Packet Reservation Multiple Access Protocol – Collision Avoidance Multiple Access Protocol – Hop Reservation Multiple Access Protocol – Soft Reservation with Multiple Access Priority Assignment – Five Phase Reservation Protocol – Real Time Medium Access Protocol. Contention based MacProtocols with Scheduling Mechanism: Distributed Priority Scheduling and Medium access in Ad Hoc Networks – Distributed Wireless ordering Protocol.

UNIT III   ROUTING PROTOCOLS IN AD HOC NETWORKS   9
Classifications - Table Driven Routing Protocols: DSDV – WRP – CHGS . On Demand Routing Protocols: DSR – AODV – TORA – LAR . Hybrid Routing Protocols: - Core Extraction Distributed Ad Hoc Routing Protocol – ZRP. Power Aware Routing Protocols: Power aware Routing Metrics – Minimal Energy Consumption Per Packet–Maximize Network Connectivity – Minimum Cost per Packet.

UNIT IV WIRELESS SENSOR NETWORKS   9
Data Dissemination – Data Gathering – MAC Protocols for Sensor Networks: Self Organizing – Hybrid TDMA/FDMA - CSMA based MAC protocol. Location Discovery: Indoor and Sensor Network Localization –Quality of a Sensor Network: Coverage and Exposure.

UNIT V ROUTING IN WIRELESS SENSOR NETWORKS   9
Directed Diffusion – Sequential Assignment Routing – Minimum Cost forwarding – Coherent and Non-Coherent Processing – Energy Aware Routing – Hierarchical Routing – Cluster based Routing Protocol – LEACH – TEEN –PEGASIS – MECN.

                                                              Total 45 Hrs

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COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Explain the concepts, architecture and applications of Ad Hoc and WSN.

CO2: Analyze the MAC protocol design concepts in Ad Hoc networks.

CO3: Design Ad Hoc routing protocols with respect to some protocol design issues.

CO4: Identify different MAC protocols and evaluate the QOS related performance measurement of Sensor Networks.

CO5: Recognize various routing protocols and its issues in WSN.

TEXT BOOKS:

1) C. Siva Ram Murthy and B.S. manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2012.
2) Carlos de Morais Cordeiro, Dharma Prakash Agrwal, Ad Hoc and Sensor Network: Theory and Applications, 2nd Edition, World Scientific Publishing Co, 2011.

REFERENCES:

1) Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.
2) C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2007.
3) Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Applications", Wiley Interscience A John Wiley & sons, INC., Publication, 2007.
4) Amiya Nayak, Ivan Stojmenovic, "Wireless Sensor and Actuator Networks – Architecture and Protocols", Pearson Education, 2010.
5) Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007

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PREREQUISITES: Software Engineering

OBJECTIVE(S):
- To know the basics of ERP
- To understand the key implementation issues of ERP
- To know the performance and business modules of ERP
- To foresee the scope and future trends in ERP.

UNIT-1   INTRODUCTION   9
ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM, CRM.

UNIT-II   ERP IMPLEMENTATION   10
Implementation Challenges – Strategies – ERP Implementation Lifecycle, Implementation Methodology, Vendors and Consultants, Contracts with Vendors, Consultants and Employees, Data migration, project management and monitoring.

UNIT-III   ERP IN ACTION AND BUSINESS MODULES   9
Operation and maintenance-performance-maximizing ERP system, Business modules in an ERP Package-Finance, Manufacturing, Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution

UNIT-IV   THE ERP MARKET   9
ERP Market Place, SAP AG, PeopleSoft, Baan, JD Edwards, Oracle, QAD,SSA Global – Lawson Software – Epicor – Intutive.

UNIT-V   ERP – PRESENT AND FUTURE   8
EIA, ERP and E-Business, ERP and Internet, ERP-II, Total quality management, Future Directions, Trends in ERP, ERP case study.

                                                           Total 45 Hrs

COURSE OUTCOMES:
At the end of the course the students are able to
- CO1: Comprehend the benefits of ERP, Business Process Reengineering and its related terminologies.
- CO2: Understand various underlying factors governing the implementation of ERP system.
- CO3: Understand the various ERP packages business modules that help in decide the place of ERP System in market.
- CO4: Acquire knowledge about the Components of ERP market.
- CO5: Understand and accommodate to the changing trends of ERP

TEXT BOOK:

1. Alexis Leon, "ERP Demystified", Second Edition, Tata McGraw Hill, New Delhi, 2008.

REFERENCE BOOKS:

1. Leon –" Enterprise resource planning", Tata McGraw Hill, 2010.

2. Mary Sumner, "Enterprise Resource Planning", Pearson Education, 2007.

3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI, New Delhi, 2003

4. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA, 2001.

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OBJECTIVE(S):

- Define basic concepts in modeling and simulation (M&S)
- Introduce students to the simulation and modeling techniques
- Provide students with opportunities to develop basic simulation and modeling skills with respect to carrying out research projects using any simulation method on the computer.

UNIT I   INTRODUCTION TO SIMULATION   9

Introduction – Simulation Terminologies- Application areas – Model Classification – Types of Simulation- Steps in a Simulation study- Concepts in Discrete Event Simulation - Simulation Examples.

UNIT II   MATHEMATICAL MODELS   9

Statistical Models - Concepts – Discrete Distribution- Continuous Distribution – Poisson Process- Empirical Distributions- Queueing Models – Characteristics- Notation – Queueing Systems – Markovian Models- Properties of random numbers- Generation of Pseudo Random numbers- Techniques for generating random numbers-Testing random number generators- Generating Random-Variates- Inverse Transform technique – Acceptance- Rejection technique – Composition & Convolution Method.

UNIT III   ANALYSIS OF SIMULATION DATA   9

Input Modeling - Data collection - Assessing sample independence - Hypothesizing distribution family with data - Parameter Estimation - Goodness-of-fit tests - Selecting input models in absence of data- Output analysis for a Single system – Terminating Simulations – Steady state simulations.

UNIT IV VERIFICATION AND VALIDATION   9

Model Building – Verification of Simulation Models – Calibration and Validation of Models – Validation of Model Assumptions – Validating Input – Output Transformations.

UNIT V SIMULATION OF COMPUTER SYSTEMS AND CASE STUDIES   9

Simulation Tools – Model Input – High level computer system simulation – CPU – Memory Simulation – Comparison of systems via simulation – Simulation Programming techniques - Development of Simulation models.

Total 45 Hrs

COURSE OUTCOMES:

At the end of the course, the students should be able to:

CO1:Classify various simulation models and give practical examples for each category

CO2:Construct a model for a given set of data and motivate its validity

CO3:Generate and test random number variates and apply them to develop simulation models

CO4:Analyze output data produced by a model and test validity of the model

CO5.Explain parallel and distributed simulation methods

TEXT BOOKS:

1. Jerry Banks and John Carson, " Discrete Event System Simulation", Fourth Edition, PHI, 2005.
2. Geoffrey Gordon, "System Simulation", Second Edition, PHI, 2006 (Unit – V).

REFERENCES:

1. Frank L. Severance, " System Modeling and Simulation", Wiley, 2001.
2. Averill M. Law and W.David Kelton, " Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
3. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice", Wiley, 1998.

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OBJECTIVE(S):

- Understand the concept of semantic web and related applications
- Learn knowledge representation, modeling and aggregation using ontology.
- Realize human behavior in social web and related communities.
- Explore knowledge on visualization and application of social networks.

UNIT I INTRODUCTION   9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web - based networks - Applications of Social Network Analysis.

UNIT II KNOWLEDGE REPRESENTATION, MODELLING AND AGGREGATING   9

Ontology and their role in the Semantic Web: Ontology - based Knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web ontology Language - Modeling and aggregating social network data: State – of – the - art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS   9

Extracting evolution of Web Community from Series of Web Archive Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi - Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES   9

Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS   9

Graph theory - Centrality - Clustering - Node - Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix - based representations - Matrix and Node - Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co - Citation networks.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

At the end of the course student should be able to

CO1: Develop semantic web related applications.

CO2: Represent knowledge using ontology.

CO3: Predict human behaviour in social web and related communities.

CO4: Visualize social networks

TEXT BOOKS:

1. Peter Mika, —Social Networks and the Semant ic Web , First Edition, Springer 2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications , 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu,Yanchun Zhang and Lin Li, — Web Mining and Social Networking – Techniques and application s , First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively , IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé – Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling , IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Web , Springer, 2009.

PREREQUISITES: Object-Oriented Systems Analysis and Design

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I   FUNDAMENTALS OF PRODUCT DEVELOPMENT   9

Global Trends Analysis and Product decision – Social Trends – Technical Trends- Economical Trends – Environmental Trends – Political/Policy Trends – Introduction to Product Development Methodologies and Management – Overview of Products and Services – Types of Product Development – Overview of Product Development methodologies – Product Life Cycle – Product Development Planning and Management.

UNIT II   REQUIREMENTS AND SYSTEM DESIGN   9

Requirement Engineering – Types of Requirements – Requirement Engineering – traceability Matrix and Analysis – Requirement Management – System Design & Modeling – Introduction to System Modeling – System Optimization – System Specification – Sub-System Design – Interface Design.

UNIT III   DESIGN AND TESTING   9

Conceptualization – Industrial Design and User Interface Design – Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines – Concept Screening & Evaluation – Detailed Design – Component Design and Verification – Mechanical, Electronics and Software Subsystems – High Level Design/Low Level Design of S/W Program – Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping – Introduction to Rapid Prototyping and Rapid Manufacturing – System Integration, Testing, Certification and Documentation

UNIT IV   SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT   9

Introduction to Product verification processes and stages – Introduction to Product Validation processes and stages – Product Testing Standards and Certification – Product Documentation – Sustenance -Maintenance and Repair – Enhancements – Product EoL – Obsolescence Management – Configuration Management – EoL Disposal.

The Industry – Engineering Services Industry – Product Development in Industry versus Academia –The IPD Essentials – Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems – Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs – Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Define, formulate and analyze a problem

CO2: Solve specific problems independently or as part of a team

CO3: Gain knowledge of the Innovation & Product Development process in the Business   Context

CO4: Work independently as well as in teams and can manage a project from start to finish

TEXTBOOKS:

1. NASSCOM Student Handbook, "Foundation Skills in Integrated Product Development".

2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.

3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:

1. Hiriyappa B,- Corporate Strategy Managing the Business, Author House, 2013.

2. Peter F Drucker, People and Performance Butterworth – Heinemann [Elsevier], Oxford, 2004.

3. Vinod Kumar Garg and Venkita Krishnan N K, —Enterprise Resource Planning – Concepts, Second Edition, Prentice Hall, 2003.

4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

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PREREQUISITES: Computer Networks

OBJECTIVES:

- To provide an overview of various network architectures, physical media, and QoS Services
- To understand the protocols for packet - switched networks.
- To gain the knowledge of Circuit-switched network and Services.
- To realize the performance of ATM and Frame Relay
- To develop a comprehensive understanding of multimedia networking and Optical networks

UNIT I   Overview   9

History of Communication Networks - Networking Principles - Future Networks - Network Services and Layered Architectures: Applications - Traffic Characterization and Quality of Service - Network Services - High Performance Networks - Network Elements - Basic Network Mechanism - Layered Architecture - Open Data Network Model.

UNIT II   Packet - Switched Networks   9

OSI and IP Models - Ethernet (IEEE 802.3) - Token Ring (IEEE 802.5) - FDDI - DQDB – Frame Relay - Internet and TCP/IP Networks: Internet Protocol - TCP and UDP - Internet Success and Limitation - Performance of TCP/IP Networks.

UNIT III   Circuit - Switched Networks   9

Performance of Circuit - Switched Networks - SONET - Dense Wave Division Multiplexing (DWDM) - Fiber to the Home - Digital Subscriber Line (DSL) - Intelligent Networks – CATV – QoS - Integrated Services – Differentiated Services

UNIT IV   Asynchronous Transfer Mode   9

Main Features of ATM - Addressing – Signaling and Routing - ATM Header Structure - ATM Adaptation Layer - Management and Control - BISDN - Internetworking with ATM- ATM Networks. – Frame Relay

UNIT V   Optical and Multimedia Networks   9

Link Level Design - Channel Access - Network Design - Optical Networks - Optical Links - Optical LANs - Optical Paths and Networks. Switching - Switch Performance Measures - Time - and Space - Division Switching - Modular Switch Designs - Packet Switching - Distributed Buffer - Shared Buffer - Output Buffer - Input Buffer. – Global Multimedia Networks

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the students will be able to
    CO1: Explain high performance network basic needs.
    CO2: Describe high performance network protocols for switched networks.
    CO3: Illustrate the Circuit-switched network mechanisms and management.
    CO4: Analyze performance of network related issues in ATM.
    CO5: Describe advanced concepts in wireless & optical network.

TEXT BOOK

1. Walrand.J, P.Varaiya, "High- Performance Communication Networks", Morgan Kaufmann Publishers, Second Edition, 2006.

REFERENCES

1. Anurag Kumar, D. Manjunath, Joy Kuri, "Communication Networking- An Analytical Approach", Morgan Kaufmann, 2011.
2. Andrew S. Tanenbaum, "Computer networks", PHI Private limited, New Delhi
3. William Stallings"ISDN and Broadband ISDN with Frame Relay and ATM,", Pearson, Fourth Edition,2005.
4. J.F. Kurose & K.W. Ross, "Computer Networking- A Top Down Approach", Pearson, Fifth Edition, 2012.
5. Nader F.Mir, "Computer and Communication Networks", Pearson Education, 2009.

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PREREQUISITES: Software Engineering

OBJECTIVES:

- To understand the basics of software quality
- To learn various metrics of software quality
- To introduce concepts behind designing of test cases
- To learn the procedure of debugging a given software

UNIT – I   INTRODUCTION TO SOFTWARE QUALITY   9

Ethical Basis for Software Quality – Total Quality Management Principles – Software Processes and Methodologies – Quality Standards, Practices & Conventions –Improving Quality with Methodologies – Structured/Information Engineering – Measuring Customer Satisfaction– Software Quality Engineering – Defining Quality Requirements – Management Issues for Software Quality – Data Quality Control – Benchmarking and Certification.

UNIT –II   SOFTWARE QUALITY METRICS AND RELIABILITY   9

Writing Software Requirements and Design Specifications – Software Metrics – Lines of Code, Cyclomatic Complexity, Function Points, Feature Points – Software Cost Estimation– Reliability Models – Reliability Growth Models – OO Metrics.

UNIT – III   TEST CASE DESIGN   9

Testing as an Engineering Activity – Testing Fundamentals – Defects – Strategies and Methods for Black Box Test Case Design – Strategies and Methods for White-Box Test Case design – Test Adequacy Criteria – Evaluating Test Adequacy Criteria – Levels of Testing and different types of testing – OO Testing - Agile Testing.

UNIT – IV   TEST MANAGEMENT   9

Testing and Debugging Goals and Policies – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Process and the Engineering Disciplines – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT – V   CONTROLLING AND MONITORING   9

Measurement and Milestones for Controlling and Monitoring – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans – Reporting review results.

TOTAL HOURS: 45

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

    CO1: Analyze software documentations using inspections and walkthrough

    CO2: Associate various software metrics to estimate the software cost

    CO3: Apply various testing strategies to test and manage software

    CO4: Understand the principles behind SCM and identify the issues.

TEXT BOOKS:

1. Stephen Kan, "Metrics and Models in Software Quality", Addison-Wesley, Second Edition, 2004.
2. Ilene Burnstein, "Practical Software Testing", Springer International Edition, Chennai, 2003.

REFERENCES:

1. Milind Limaye, "Software Quality Assurance", McGraw Hill, 2011.
2. M G Limaye, "Software Testing – Principles, Techniques and Tools", McGraw Hill, 2011.
3. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, New Delhi, 1995.
4. Elfriede Dustin, "Effective Software Testing", Pearson Education, New Delhi, 2003.
5. RenuRajani and Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill, New Delhi, 2003.

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PREREQUISITE: Data Warehousing and Data Mining

OBJECTIVES:

- To use the knowledge management tools.
- To apply knowledge management models in various business scenarios.
- To design and develop enterprise applications.

UNIT I   INTRODUCTION   9

An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems - Knowledge Discovery - The Evolution of Knowledge management - Key Challenges - Ethics.

UNIT II   CULTURE OF LEARNING AND KNOWLEDGE SHARING   9

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance. Technologies to Manage Knowledge

UNIT III   KNOWLEDGE MANAGEMENT TOOLS   9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV   KNOWLEDGE MANAGEMENT-APPLICATION   9

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries), Role of Knowledge Management in Social Network Analysis.

UNIT V   FUTURE TRENDS AND CASE STUDIES   9

Case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life-cycles of an organization.

TOTAL: 45

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COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

    CO1: Learn the Evolution of Knowledge management.

    CO2: Apply knowledge management models and technologies to business situations.

    CO3: Explore various knowledge management tools.

    CO4: Exposed to various fields of applications.

    CO5: Use a knowledge management system for an organization.

TEXT BOOK:

1. Srikantaiah.T. K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000.

REFERENCE:

1. Nonaka, I., Takeuchi, H., "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995.

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OBJECTIVES:
- To learn the concepts of Web design patterns and page design.
- To understand and learn the scripting languages with design of web applications.
- To learn the maintenance and evaluation of web design management

UNIT I SITE ORGANIZATION AND NAVIGATION   9

User Centered Design – Web Medium – Web Design Process – Basics of Web Design – Introduction to Software used for Web Design – DREAM WEAVER, FLASH – Evaluating Process – Site Types and Architectures – Navigation Theory – Basic Navigation Practices – Search Sitemaps.

UNIT II ELEMENTS OF PAGE DESIGN   9

Browser Compatible Design Issues - Pages and Layout – Templates – Text – Color – Images – Graphics and Multimedia – GUI Widgets and Forms – Web Design Patterns – Creation and Editing of site map – Bootstrap Design tool - CSS style – Forms – Tools like Insert, Rollover etc., in DREAM WEAVER.

UNIT III SCRIPTING LANGUAGES AND ANIMATION USING FLASHF   9

Client side scripting :AngularJS Designing a Simple Web Application –Introduction to MACROMEDIA FLASH, Importing Other File Formats to Flash –Saving and Exporting Flash Files, Frame by Frame Animation–Motion Tweening –Shape Tweening.

UNIT IV PRE-PRODUCTION MANAGEMENT   9

Principles of Project Management –Web Project Method –Project Road Map –Project Clarification – Solution Definition –Project Specification –Content –Writing and Managing Content.

UNIT V PRODUCTION, MAINTENANCE AND EVALUATION   9

Design and Construction –Testing, Launch and Handover –Maintenance –Review and Evaluation –Case Study: Using the Skills and Concepts Learn with the ADOBE IMAGE READY, DREAM EAVER, FLASH, and Scripts, Develop Portfolios in the Form of Web Pages which have to be uploaded in Free Public Domains.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students should be able to:

CO1: Identify the various issues of web design process and evaluation.

CO2: Determine templates for web pages and layout.

CO3: Develop simple web applications using scripting languages.

CO4: Determine the various issues of web project development.

CO5: Address the core issues of webpage maintenance and evaluation.

TEXT BOOKS:

1. Ashley Friedlein, ―Web Project Management , Morgan Kaufmann Publishers, 2001.
2. H.M. Deitel, P.J. Deitel, A.B. Goldberg, ―Internet and World Wide Web–How to Program , Third Edition, Pearson Education, 2004.

REFERENCE BOOKS:

1. Themas A. Powell, ―The Complete Reference–Web Design , Tata McGraw Hill, Third Edition, 2003.
2. Lynda Weinman and Garo Green, Dreamweaver 3 Hands –on Training,Pearson Education, 2004.
3. Joel Sklar, ―Principles of Web Design , Thomson Learning, 2001.
4. Van Duyne, Landay and Hong, ―The Design of Sites: Patterns for Creating Winning Websites , second Edition, Prentice Hall, 2006.
5. Lynch, Horton and Rosenfeld, ―Web Style Guide: Basic Design Principles for Creating Websites , Second Edition, Yale University Press, 2002.
6. Deke McClelland, ―Photoshop 7 Bible , Professional Edition, Wiley John and Son Inc., 2000.
7. Curtis Hillman, ―Flash Web Design , First Edition, New Riders Publishing,2000

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PREREQUISITES: Cryptography and Security in Computing

OBJECTIVE(S):

- To know the fundamentals of cyber forensics and the role of forensic specialist.
- To learn investigation strategies to uncover hidden information in digital systems.
- To understand ethics and legality of hacking.
- To get familiarized with different scanning and enumeration methodologies and tools.

| UNIT -I | Fundamentals of Cyber Forensics | 9 |

Introduction to computer forensics - Use of computer forensics in law enforcement - Computer forensics services - Benefits of professional forensics methodology - Anatomy of Digital Investigation - Information Security Investigations - Corporate Cyber Forensics - Scientific method in forensic analysis - Investigating large scale Data breach cases - Analyzing Malicious software.

| UNIT-II | Cyber Forensics Investigation | 9 |

Introduction – Investigation Tools – eDiscovery – Digital Evidence Collection – Evidence Preservation – E-Mail Investigation – E-Mail Tracking – IP Tracking – E-Mail Recovery – Search and Seizure Computers – Recovering deleted evidences – Password Cracking – Cracking with GPU Systems – Hashcat.

| UNIT – III | Data Acquisition, Validation and Report Writing | 9 |

Data Acquisition – Finding Lost Files – Document Analysis – Validating Forensic Data – Addressing Data-Hiding Techniques – Performing Remote Acquisitions - Case Management and Report Writing – Building a Forensics Workstation

| UNIT – IV | Ethical Hacking | 9 |

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing - Types and phases of Penetration– Penetration Testing Tools.

| UNIT-V | Ethical Hacking in Web | 9 |

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers – Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 Hours

COURSE OUTCOMES:

Upon successful completion of this course, students should be able to:

CO1: Analyze the role of forensics in preventing various forms of fraud.
CO2: Examine digital evidences such as the data acquisition, identification analysis.
CO3: Analyze and validate forensic data.
CO4: Defend a computer against a variety of security attacks using scanning and penetration testing tools.
CO5: Protect personal data, Secure computer networks and know safe internet usage.

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TEXT BOOKS:

1. Michael Graves, "Digital Archaeology: The Art and Science of Digital Forensics", Addison-Wesley Professional, 2014.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

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1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005.
2. Albert J. Marcella and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence, Wiley, 2015.
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010.
4. Marjie T. Britz, "Computer Forensics and Cyber Crime", 2nd Edition, Pearson, 2017.
5. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2012.
6. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013.
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8. Bill Nelson, Amelia Phillips and Christopher Steuart, —Guide to Computer Forensics and Investigations , Fourth Edition, Cengage, 2013.
9. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Published by Dr. Ali Jahangiri, 2009.

PREREQUISITES: Computer Networks

OBJECTIVE(S):
- To know the difference between traditional networks and software defined networks.
- To know the reduced complexity of network operation.
- To obtain skills about data centers and programming.
- To understand the faster time to revenue for new applications.

UNIT -I SDN: Introduction   9
Traditional Switch Architecture - Evolution of Switches and Control Planes - Centralized and Distributed Control and Data Plane - Data Center Innovation, Data Center Needs – The Genesis of SDN - How SDN Works: Fundamental Characteristics of SDN, SDN Operation, SDN Devices.

UNIT-II Openflow and SDN Controller   10
OpenFlowOverview: TheOpenFlow switch, The OpenFlow Controller, The OpenFlow protocol, The Controller-switch secure channel, Open Flow 1.0 and OpenFlow Basics - SDN Controllers and concepts.

UNIT – III   Data Centers   9
Multitenant and Virtualized Multitenant Data center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE – The Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller/Framework.

UNIT-IV Programming SDN   10
Network Programmability: Management Interface – The Application-Network Divide – The Command-Line Interface – NETCONF and NETMOD – SNMP – XMPP – Google's Protocol buffers – Thrift – JSON – I2RS. Modern Orchestration: OpenStack – CloudStack – Puppet.

UNIT-V   Network Function Virtualization (NFV) and SDN Application   7
Concepts – Implementation – Applications of NFV – SDN Applications: WAN – Service Provider and Carrier Networks – Campus Networks – Hospitality Networks – Mobile Networks – Inline Network Function – Optical Networks.

TOTAL: 45 Hours

COURSE OUTCOMES:
Upon successful completion of this course, students should be able to:

CO1: Compare and contrast between traditional switch architecture and software defined networks.

CO2: Understand the functionality of Openflow protocol and SDN controllers.

CO3: Illustrate use of SDN in Data Centers and other environments.

CO4: Use software programs to perform varying and complex networking tasks.

CO5: Expand the knowledge learned and apply it to solve real world problems.

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TEXT BOOKS:

1. Paul Goransson, Chuck Black, and Timothy Culver: Software Defined Networks A Comprehensive Approach, Second Edition, Elsevier, 2014.
2. Thomas D. Nadeau & Ken Gray: SDN Software Defined Networks O'Reilly publishers, Second edition, 2017.

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1. FEI HU, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, Taylor & Francis Group, 2014.
2. Siamak Azodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
3. VivekTiwari, —SDN and Open Flow for Beginners , Amazon Digital Services, Inc., 2013.

ONLINE REFERENCES:

1. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org.

2. OpenFlow standards, http://www.openflow.org.

3. Online Reading lists, including: http://www.nec-labs.com/~lume/sdn-reading-list.html.

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