NOTIFICATION

No. 121 /2023 Date : 17/08/2023

Subject: (i) Revised Syllabi of Semester I to VIII of B.E. (Computer Science & Engineering) & Semester III & IV of B.E. (Computer Engineering) (CBCS) as per AICTE model Curriculum.

(ii) Substitution of Text Books & Reference Books for the subject 8KS02 Professional Ethics and Management

It is notified for general information of all concerned that the authorities of the University have accepted to implement the following to be implemented from the academic session 2023-2024 onwards as under:

(i) Revised Syllabi of Semester I V to VIII of B.E. (Computer Science & Engineering) & Semester III & IV of B.E. (Computer Engineering) **(CBCS)** as per A.I.C.TE. Model Curriculum to be implemented from the academic session 2023-2024 onwards.

1A4 COMPUTER PROGRAMMING

Aim: The course is aimed at impart knowledge to analyze, solve, design and code real-life problems using C language

Course Outcomes: At the end of course, the students will be able-

1. To explain fundamental concepts of computer and computing.
2. To test and execute the programs and correct syntax and logical errors.
3. To implement conditional branching, iteration and recursion.
4. To use arrays, pointers and structures to formulate algorithms and programs.
5. To recognize various problem solving techniques and computer applications.
6. To apply programming concepts to solve real life problems.

UNIT I: Fundamental of the Computer and Computing Concepts : Generation of computers, Classification of computers, Basic Anatomy of Computer System, Input Devices, Processor, Output Devices, Memory Management, Types of Computer Software, Overview of Operating system, Networking Concepts, Microsoft Office, Number systems: Decimal, Binary, Hexadecimal, Octal, Conversion of Numbers, Binary Arithmetic Operations, Programming Languages, Logicgates. (8)

UNIT II: C Fundamentals: Introduction, Importance of C, Basic Structure of C Programs, Program execution, Basic programs based on C such as Printing Message, Adding two numbers, Interest calculations, Use of subroutines, math function. C tokens, Keywords and Identifiers, Character set, Data Types, Constant and Variables, Declaration of Variables, Declaration of Storage Class, Operators, Types of Operators: Arithmetic, Relational, Logical, Assignment, Increment-decrement, Conditional, Bitwise, Special. Arithmetic expression, Evaluation of Expression, Precedence of Arithmetic Operators, Input-Output Operation: Reading and Writing Character, Formatted Input, Formatted Output. (8)

UNIT III: C Control Constructs: Decision-making using if, if-else, nested if, else if ladder and switch-casestatements,?:Operator,GotoStatement,Loopsusingfor,while,do-while statements, break and continue statements, Jumps in Loops, Concise Test Expressions. (8)

UNITIV: Array, Strings and Structures: Introduction to array, One Dimensional Array: Declaration & Initialization, Two Dimensional: Declaration & Initialization, Multi-Dimensional, Strings: Declaration and Initialization, Reading String from terminal, Writing String to Screen, Putting Strings together, Comparison of Two Strings, String-Handling Functions, Table of Strings, Other features of String (8)

UNITV: User Defined Functions, &Pointers: Functions, Need for User defined Functions, Multi Function Program, Elements of User Defined Functions, Return Values and their types, Function Calls, Function Declaration, and Categories of Functions. Definition and uses of pointers, Address of operator , Pointer Arithmetic, pointers and functions, parameter passing mechanism using pointers, pointers and arrays, arrays of pointers, pointers and string.

UNIT VI: Structures and File Management: Structures – Define, Declaration, Accessing the members of a Structure, Accessing address of variable, Introduction to File Management, Defining and Opening File, Closing File, Input/output Operations on File. (8)

Text Book: E Balagurusamy: Computing Fundamentals &C Programming :TataMcGraw-Hill,2nd Edition .

Reference Books:

1. Pradeep Dey and Manas Ghosh,“ Computer Fundamentals & Programming in C” Oxford University Press, 2006.
2. K R Venugopal and S R Prasad, “Mastering C” Tata-Mc Graw Hill.
3. Seymour Lipschutz, “Data Structure Using C”, Tata-Mc Graw Hill.
4. Herbert Schildt- C Complete Reference (Tata-Mc Graw Hill).

3KS02 DISCRETE STRUCTURE AND GRAPH THEORY

Course Prerequisite: Basic knowledge of Mathematics
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:
1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3.. Apply logical reasoning to solve a variety of problem

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Perform operation on trees data structures.
6. Develop the given problem as graph networks and solve with techniques of graph theory

Unit I: The Foundations: Logic and Proofs **Hours: 8**
Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments.

Unit II: Sets, Functions and Relation **Hours: 8**
Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations ,Functions, Inverse Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations.

Unit III: Algebraic Structures **Hours: 8**
Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.

Unit IV: Boolean Algebra **Hours: 7**
Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.

Unit V: Tree **Hours: 7**
Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, Inorder Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree

Unit VI: Graph **Hours: 7**
Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings;

Text Books:
[1] Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.
[2] J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.

Reference Books:
[1] Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
[2] Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
[3] C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, Mc-Graw Hill.

3KS04 / 3KE04 DATA STRUCTURES

Course Pre-requisite: Fundamentals of programming Language & Logic Building Skills.
Course Objectives:
1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching andtraversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes: On completion of the course, the students will be able to
1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various datastructures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

Unit I: Introduction to Data Structures: (Hours:7)
Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit II: Array& Record Structure: (Hours7)
Linear arrays: Memory Representation of arrays, traversing linear arrays, insertion & deletionoperations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays. Record structures.

Unit III: Linked lists: (Hours7)
Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion & deletion operations on linked lists.Header linked lists, Two- way linked lists.

Unit IV: Stack & Queue: (Hours7)
Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi. Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues.
Unit V: Trees: (Hours7)
Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heap sort, Path length & Huffman's algorithm.

Unit VI: Graphs & Sorting Algorithms: (Hours7)
Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search. Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort.

Text Books:
1. Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, InternationalEditions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:
1. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KS05 ANALOG & DIGITAL ELECTRONICS

Course Prerequisite: Basic Physics.

Course Objectives:
1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, FieldEffect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits.

Course Outcomes:
At the end of course students will be able to:
1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization techniques to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: Diode and Characteristics: (Hours7)
PN-Junction Diode, Characteristics and Parameters, Zener Diode, Zener Diode as voltageregulator, Light Emitting Diode characteristics, Seven Segment Display, Photo Diode, PIN Diode

Unit II: Transistors and Characteristics: (Hours7)
Transistors and their Types (PNP, NPN), Transistor as an amplifier, BJT operation, BJT Voltagesand Currents, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics, Transistor testing.
Unit III: Number System: (Hours7)
Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s ComplementsRepresentation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code andAlpha numeric codes.

Unit IV: Minimization Techniques: (Hours7)
Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey MinimizationTechnique (up to 5 variable).

Unit V: Combinational Circuits: (Hours7)
Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits: (Hours7)
Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Books:
1. David A. Bell: “Electronic Devices and Circuits”, 5e , Oxford University Press.
2. Jain R.P. “Modern Digital Electronics”, 3e, TMH.

Reference Books:
1. Millman & Halkies: “Electronic Devices & Circuits”, 2e, McGraw Hill.
2. Sedra& Smith: “Microelectronics Circuits”, 5e, Oxford University Press.
3. Anand Kumar: “Switching Theory and Logic Design”, 3e, PHI Learning Private Limited
4. Wakerly, “Digital Design: Principles and Practices”, 3 e, Pearson Education, 2004.

4KS02 DATA COMMUNICATION AND NETWORKING

Course Prerequisite: Computer and Data Communication Requirements.

Course Objectives:
1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences
5. To evaluate the errors using various error detection & correction techniques
6. To understand network based protocols in data communication and networking

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

1. Describe data communication Components Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital to digital Conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion.
3. Explain the various multiplexing method and evaluate the different error detection & correction techniques
4. Illustrate and realize the data link control and data link protocols
5. Describe and demonstrate the various Local area networks and the IEEE standards

Unit I: Introduction to Data Communication **(Hours:7)**
Introduction Data Communication Components, Networks, Network types: Local Area Network, Wide Area Network, Switching. The Internet, Accessing the Internet, Standards and Administration: Internet Standard Internet Administration, Network Models TCP/IP Protocol Suite, the OSI Model.

Unit II: Guided &Unguided Media, Switching and Data Link Layer **(Hours:7)**
Transmission media introduction, Guided median & Unguided media-Wireless. Switching Introduction, Circuit Switch Networks Packet Switching Data Link Layer: Introduction, Nodes & Links, Services, Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC) Random Access, Controlled Access, Channelization.

Unit III: Network Layer **(Hours: 7)**
Introduction to Network layer Network Layer Services: Packetizing. Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service, Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing. Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as packet Switches

Unit IV: Network Layer Protocol **(Hours: 7)**
Network Layer Protocols: Internet Protocol (IP), Datagram Format, Fragmentation, Security of IPv4 Datagrams, ICMPV4: Messages, Debugging Tools, ICMP Checksum Mobile IP: Addressing. Agents, Three Phases, Inefficiency in Mobile IP Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing Representation, Address Space, Address Space Allocation, Auto configuration. Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Transport Layer **(Hours: 7)**

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN). Selective-Repeat Protocol, Bidirectional Protocols: Piggy backing. User Datagram Protocols: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Application layer **(Hours: 7)**

Introduction to Application layer: Providing Services. Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication, World wide web and HTTP World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP, Electronic Mail: Architecture, Web-Based Mail, E-Mail Security, Domain Name System (DNS) Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS.

Text Book: Behrouz A. Forouzan: Data Communication and Networking. (5/e) (TMH).

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber: Data Communication, McGraw Hill
3. J.Freey: Computer Communication & Networks, AEW Press
4. D. Corner Computer Networks & Internet, Pearson Education.

4KS05 THEORY OF COMPUTATION

Course Pre-requisite: Discrete Mathematics, Data Structures

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

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

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines: (Hours 8)

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFAand DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Minimization of Finite Automata (Construction of Minimum Automaton).

Unit II: Finite Automata with output and Regular Expression: (Hours 8)

Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE.

Unit III: Regular Language and Regular Grammar: (Hours 8)

Conversion of FA to RE using Arden"s Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG(RLG and LLG) and FA.

Unit IV: Context Free Grammar and Languages: (Hours 8)

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit V: Pushdown Automata: (Hours 8)

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties ofCFL, Context Sensitive Language, Linear Bounded Automata.

Unit VI: Turing Machines and Decidability and Un-Decidability: (Hours 8)
Formal definition of a Turing Machine, Design of TM,Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine. Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages.

Text Books:
1. Hopcraft H.E. & amp; Ullman J: Introduction to Automata Theory, Languages and Computation.
2. Peter Linz: An Introduction to Formal Languages and Automata.

Reference Books:
1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni : Theory of Computation, OUP India, 2013.

5KS01 DATABASE MANAGEMENT SYSTEMS

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of DatabaseManagement Systems by being able to do each of the following:
1. To understand the fundamental concepts of database management system.
2. To learn database query languages.
3. To give systematic database design approaches covering conceptual design, logical design andan overview of physical design.
4. To understand the query processing and optimization.
5. To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to
1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS: (Hours 8)
Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to RelationalSchemas, E-R design issues, Extended E-R Features.

Unit II: Relational Algebra, SQL: (Hours 8)
Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design: (Hours 8)
Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs, atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization: (Hours 8)
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation (Nested Loop & Block Nested Loop Join), Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions Estimating Statistics of Expression Results, , Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management: (Hours 8)
Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system: (Hours 8)
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage , early lock release and logical undo operations, , Remote Backup Systems

Text Book:
Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, SixthEdition, McGraw Hill

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

5KS02 COMPILER DESIGN

Course Pre-requisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of CompilerDesign by being able to do each of the following:

- To learn concepts of programming language translation and phases of compiler design
- To understand the common forms of parsers.
- To study concept of syntax directed definition and translation scheme for the representation oflanguage
- To illustrate the various optimization techniques for designing various optimizing compilers.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:
1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers.
3. Solve various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment.
6. Explain the concept of code generation and code optimization.

Unit I: Introduction to Compiler: (Hours 7)
Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, Thelexical analyzer generator Lex, Finite Automata.

Unit II: Syntax Analysis: (Hours7)
Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Nonrecursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing: (Hours7)
Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation: (Hours7)
Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDD's: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation: (Hours7)
Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), ThreeAddress Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences,Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation: (Hours7)
Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book:
Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniquesand Tools", Pearson Education Second Edition.

Reference Books:
1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools",Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
4. K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE.
5. Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

5KS03 COMPUTER ARCHITECTURE & ORGANIZATION

Course Prerequisite: Microprocessor& Assembly Language Programming

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:
1. To discuss the basic concepts and structure of computers.
2. To solve concepts of arithmetic operations.
3. To understand addressing modes and memory organization.
4. To analyze conceptualize multitasking ability of a computer and pipelining
5. To explain IO communication

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to
1. Discuss the basic structure of a computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer: (Hours7)
Bus structures, Addressing Methods, and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes, Basic I/O Operations.

Unit II: Memory Unit: **(Hours7)**
Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit: (Hours7)
Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization: (Hours7)
Accessing I/O Devices, Interrupts, Enabling and Disabling Interrupts, Handling Multiple Devices, DMA, I/O Hardware, Standard I/O Interfaces: SCSI.

Unit V: Arithmetic: (Hours7)
Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers, Booth Multiplier, Fast Multiplication, Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining: (Hours7)

Parallel Processing, Array Processors, The Structure of General-Purpose Multiple Processors, Symmetric, Multiprocessors, Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

TextBook: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth EditionTata Mc-Graw Hill**.**

Reference Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance",Eighth Edition, Pearson.
2. John P. Hayes, "Computer Architecture and Organization", McGraw Hill Publication.
3. DA Patterson and JLHennessy,Computer Organization and Design, Morgan KaufmannPublisher, 2nd edition
4. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication

5KS04 PE-I: (iv) INTRODUCTION TO CYBER SECURITY

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding ofIntroduction to Cyber Security by being able to do each of the following:

- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome):
After completion of this course, the students should be able to:

1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

Unit I: (Hours 7)
Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: (Hours 7)
Cyber offenses: Introduction, Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: (Hours 7)
Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: (Hours 7)

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing,Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: (Hours 7)
Access Control and Authorization: Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization. Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentications, Authentication Methods.

Unit VI: (Hours 7)

System Intrusion Detection and Prevention: Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools.

Text Books:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, ComputerForensics and Legal.
2. Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791,2013
3. Joseph Migga Kizza, “A Guide to Computer Network Security”, Springer 2009.

Reference Books:

1. V.K. Pachghare, “Cryptography and information Security”, PHI Learning Private Limited,Delhi India.
2. Nina Godbole, “Information Systems Security”, Wiley India, New Delhi
3. Kennetch J. Knapp, “Cyber Security & Global Information Assurance”, Information SciencePublishing.
4. James Graham, Richard Howard, Ryan Olson, “Cyber Security Essentials” CRC Press.
5. Jeetendra Pande, “Introduction to Cyber Security” Uttarakhand Open University, 2017.

5KS04 (Prof. Elect. – I) (ii) DATA SCIENCE AND STATISTICS

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:
1. To understand the need of data science and Statistics
2. To understand the knowledge of statistics data analysis techniques utilized in business decision making.
3. To understand and apply the different data modeling strategies.
4. To apply the learned concept for skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Explain basics and need of data science
2. Describe proficiency with statistical analysis of data.
3. Demonstrate loading of data and its manipulation for data science
4. Perform linear and multiple linear regression analysis.
5. Develop the ability to build and assess classification-based models
6. Evaluate outcomes and make decisions based on data.

Unit I: Introduction to Data Science: **(Hours7)**
Data Science: Relation with other fields, Relationship between Data Science and Information Science, Computational Thinking, Skills for Data Science, Tools for Data Science, Issues of Ethics, Bias, and Privacy in Data Science Data: Data types, Data Collection, Data Pre-processing.

Unit II: Techniques: **(Hours7)**
Techniques: Introduction, Data Analysis and Data Analytics, Descriptive Analysis, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis, Regression.

Unit III: Python for Data Science **(Hours7)**
Python: Introduction, Getting Access to Python, Basic Examples, Control Structures, Statistics Essentials: Importing Data, Plotting the Data, Correlation, Linear Regression, Multiple Linear Regression.

Unit IV: Machine Learning for Data Science **(Hours7)**
Introduction: Machine Learning, Classification (Supervised Learning), Clustering (Unsupervised Learning), Regression, Gradient Descent

Unit V: Supervised Learning **(Hours7)**
Supervised Learning: Introduction, Logistic Regression, SoftMax Regression, Classification with KNN, Decision Tree, Random Forest, Naïve Bayes.

Unit VI: Unsupervised Learning **(Hours7)**
Unsupervised Learning: Introduction, Agglomerative Clustering, Divisive Clustering, Expectation Maximization (EM), Introduction to Reinforcement Learning.

Text Book:

Chirag Shah,"A Hands-on Introduction to Data Science", Cambridge University Press (2020) ISBN:978-1-108-47244-9.

Reference Books:
1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN:978-1-449-35865-5.
2. Data Mining: Concepts and Techniques By Jiawei Han, Jian Pei, Micheline Kamber
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learningwith Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

5KS08 EMERGING TECHNOLOGY LAB - I
(Data Science and Statistics Lab - I)

Course Prerequisite: Basic knowledge of Mathematics.

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:
1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

List of Experiments:
This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two (2) experiments should be beyond syllabi based on learning of syllabi.

List of Experiments based on Syllabus:
[1] Introduction to Basics of Python:
[2] Variable creation, Arithmetic and logical operators, Data types and associated operations Sequence data types and associated operations, Strings, Lists, Arrays, Tuples, Dictionary, Sets, Range, Loops and Conditional Statement's Linear Regression:
[3] To learn different Libraries in Python and to perform Simple Linear Regression and Multiple Linear Regression
[4] To learn Interaction Terms and to perform Non-linear Transformations of the Predictors
[5] To learn and evaluate Qualitative Predictors
[6] To learn to Write Functions Logistic Regression, LDA, QDA, and KNN
[7] To perform Logistic Regression
[8] To perform Linear Discriminate Analysis
[9] To perform Quadratic Discriminate Analysis
[10] To implement K-Nearest Neighbors technique
[11] To use Caravan Insurance Data for LR, LDA, QDA, and KNN Cross-Validation and the Bootstrap
[12] To learn and perform The Validation Set Approach
[13] To learn and perform Leave-One-Out Cross-Validation
[14] To learn and perform k-Fold Cross-Validation
[15] To learn and perform The Bootstrap Subset Selection Methods
[16] To learn and perform Best Subset Selection
[17] To learn and perform Forward and Backward Stepwise Selection
[18] To learn to Choose Among Models Using the Validation Set Approach and Cross-Validation Ridge Regression and the Lasso
[19] To learn and perform Ridge Regression
[20] To learn and perform The Lasso Decision Trees
[26] To learn and perform Fitting Classification Trees
[27] To learn and perform Fitting Regression Trees
[28] To learn and implement Bagging and Random Forests
[29] To learn and perform Boosting.
Support Vector Machines
[30] To learn and perform Support Vector Classifier
[31] To learn and perform Support Vector Machine
[32] To learn and perform ROC Curves
[33] To learn and perform SVM with Multiple Classes
[34] To use Gene Expression Data Clustering
[35] To implement K-Means Clustering
[36] To implement Hierarchical Clustering
[37] NCI60 Data Example
[38] To implement PCA on the NCI60 Data
[39] To Cluster the Observations of the NCI60 Data.

List of Experiments beyond Syllabus: (Maximum 05)
1. To implement the Association Rules
2. To implement the kernel method to increase data separation
3. Develop a data model and deploy it as R HTTP Services or by export
4. Develop a data model and present it to end user with proper presentations
5. Carry out your assigned task and present it to other data scientist with proper presentations.

Text Books:
1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

Reference Book:
Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

6KSO4 Prof. Elect. II (iv) CRYPTOGRAPHY

Course Prerequisite: Discrete Structure & Graph Theory, Data Communication and Networking,Introduction to Cyber security

Course Objectives: Throughout the course, students will be expected to demonstrate theirunderstanding of Cryptography by being able to do each of the following:

1. Understand Security Concepts.
2. Know about various encryption techniques.
3. Understand the concept of public key cryptography.
4. Study message authentication and hash functions.
5. Impart knowledge on Network security, Internet Security Protocols.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Discuss authentication applications
5. Summarize the intrusion detection and its solutions to overcome the attacks.
6. Understand basic concepts of system level security

Unit I: (Hours7)
Cryptography: Concepts and Techniques Introduction, Plain Text and Cipher Text, Substitution and Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stenography, Key Range and Key Size, Possible Types of Attacks.

Unit II: (Hours7)
Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Advanced Encryption Standard(AES).

Unit III: (Hours7)
Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, History and Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Cryptography,Digital Signatures.

Unit IV: (Hours7)
Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML, PKI and Security, Creating Digital Certificate.

Unit V: (Hours7)
Internet Security Protocols: Introduction, Concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hypertext Transport Protocol (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), SSL Versus SET, Electronic Money, Email Security.

Unit VI: (Hours7)
User Authentication: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based-Authentication, Biometric Authentication.

Text Book: Atul Kahate, “Cryptography and Network Security”, McGraw Hill, Second Edition.

Reference Books:

1. William Stallings, “Cryptography and Network Security, Principles and Practice”, PHI FourthEdition.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay,“Cryptography and Network Security”,Mc-Graw Hill, Second Edition.
3. Matt Bishop, “Computer Security Arts and Science”,Pearson Education.
4. Douglas R Stinson, “Cryptography, Theory and Practice” CRC Press.
5. Keith M Martin, “Everyday Cryptography, Fundamental Principles and Applications”, OxfordUniversity Press, Second Edition.

7KS02 COMPUTER GRAPHICS

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linearalgebra, vectors and matrices.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of ComputerGraphics by being able to do each of the following:

- To acquaint the learner with the basic concepts of Computer Graphics.
- To learn the various algorithms for generating and rendering graphical figures.
- To get familiar with mathematics behind the graphical transformations.
- To understand various methods and techniques regarding projections, animation, shading,illumination, and lighting

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:
1. Describe the basic concepts of Computer Graphics.
2. Demonstrate various algorithms for basic graphics primitives.
3. Apply 2-D geometric transformations on graphical objects.
4. Use various Clipping algorithms on graphical objects.
5. Explore 3-D geometric transformations, curve representation techniques and projectionsmethods.
6. Explain visible surface detection techniques and Animation.

Unit I: Introduction and Overview of Graphics System: (Hours:7)
Definition and Representative uses of computer graphics, Overview of coordinate system, Definition of scan conversion, rasterization and rendering. Raster scan & random scan displays, Architecture of raster graphics system with display processor, Architecture of random scan systems.

Unit II: Output Primitives: (Hours:7)
Scan conversions of point, line, circle: DDA algorithm and Bresenham algorithm for line drawing,midpoint algorithm for circle; Aliasing, Antialiasing techniques like Pre and post filtering, super sampling, and pixel phasing.

Unit III: Two Dimensional Geometric Transformations: (Hours:7)
Basic transformations: Translation, Scaling, Rotation , Matrix representation and Homogeneous Coordinates Composite transformation Other transformations: Reflection and Shear

Unit IV: Two-Dimensional Viewing and Clipping: (Hours:7)
Viewing transformation pipeline and Window to Viewport coordinate transformation , Clipping operations: Point clipping, Line clipping algorithms: Cohen-Sutherland, Liang: Barsky.

Unit V: Three Dimensional Geometric Transformations, Curves and Fractal Generation: (Hours:7)
3D Transformations: Translation, Rotation, Scaling and Reflection, Composite transformations:Rotation about an arbitrary axis, Projections – Parallel, Perspective. (Matrix Representation),Bezier Curve, B-Spline Curve.

Unit VI: Visible Surface Detection and Animation: (Hours:7)
Visible Surface Detection: Classification of Visible Surface Detection algorithm, Back Surface detection method, Depth Buffer method, Area Subdivision method Animation: Introduction, Design of animation sequences, Animation languages, Keyframe, Morphing, Motion specification.

Text Book: Hearn, Baker, "Computer Graphics (C version)" – Pearson Education.

Reference Books:
1. J. Foley, V. Dam, S. Feiner, J. Hughes, Computer Graphics Principles and Practice‖, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, Mathematical Elements for Computer Graphics‖, 2nd Edition, Tata Mc-Graw Hill. Publication, 2002, ISBN 0 – 07 – 048677 – 8.
3. Mario Zechner, Robert Green, Beginning Android 4 Games Development‖, Apress, ISBN: 978-81- 322- 0575-3.

7KS04 PE III: DIGITAL FORENSICS

Course Prerequisite: Data Communication & Networking, Introduction to Cyber Security, Cryptography

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of DigitalForensics by being able to do each of the following:
- To understand the basic digital forensics and techniques for conducting forensic examinationson different digital devices.
- To understand how to examine digital evidence such as data acquisition and identificationanalysis.
- To understand the basics of mobile phone forensics.
- To understand network based cyber security intrusion detection.
- To know the various forensics tools.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to:
1. Describe Digital Forensics and its related preparation.
2. Outline Data Acquisition tools
3. Use knowledge to improve crime investigations.
4. Examine Digital Forensic and its validation.
5. Assess role of email and social media in investigations
6. Discuss Cloud Forensics.

Unit I: (Hours7)
Introduction: An Overview of Digital Forensics, Preparing for Digital Investigations, Preparing A Digital Forensics Investigations, Procedure for Private Sector High-Tech investigations, understanding data recovery workstation and software, conducting and investigations.

Unit II: (Hours7)
Data Acquisition: Understanding storage formats for digital evidence, determining the best acquisition method, Contingency planning for Image acquisition, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensicsacquisitions tools.

Unit III: (Hours7)
Processing Crime and Incident Scenes: Identifying Digital Evidence, Collection Evidence in Private Sector Scenes, Processing Law Enforcement Crime Scenes, Preparing for a search,Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the scene, Storing a DigitalEvidence, Obtaining a Digital Hash,

Unit IV: (Hours7)
Digital Forensic Analysis and Validation: Data to collect and analyze, Validating Forensic data, Addressing data hiding techniques, Virtual Machine Forensics, Live Acquisition and Network Forensics

Unit V: (Hours7)
Email and Social Media Investigations: Role of Email in investigations, Roles of Client and server in Email, Investigating Emails Crimes and Violations, Email Servers, Specialize Email Forensic Tools, Digital Forensics to Social Media Communications.

Unit VI: (Hours7)
Cloud Forensics: Cloud Computing, Legal Challenges in Cloud Forensics, Technical Challenges in Cloud Forensics, Acquisitions in the cloud, conducting a cloud investigation, Tools for Cloud Forensics.

Text Book:
Nelson, B, Phillips, A, Stuart, C., “Guide to Computer Forensics and Investigations”, 6th Ed., Cengage Learning.

Reference Books:
1. Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”,Addison Wesley, 2002.
2. Davidoff, S. and Ham, J., Network Forensics Tracking Hackers through Cyberspace, PrenticeHall, 2012.
3. Michael G. Solomon, K Rudolph, Ed Tittel, Broom N., and Barrett D., Computer ForensicsJump Start, Willey Publishing, Inc., 2011.
4. Marcella, Albert J., Cyber forensics: A field manual for collecting, examining and preservingevidence of computer crimes, New York, Auerbach publications, 2008.
5. Davidoff, Sherri, Network forensics: Tracking hackers through cyberspace, Pearson educationIndia private limited, 2017.
6. John Sammons, The Basics of Digital Forensics, Elsevier, 1st Edition, 2015.

7KS04 Prof. Elect. III: (ii) DATA WAREHOUSE AND MINING

Course Prerequisite: Basic knowledge of Database management system

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Data Warehouse and Mining by being able to do each of the following:

- Introduce the basics of data mining, data types, similarity and dissimilarity measures.
- Explain association rules and algorithms.
- Be familiar with mathematical foundations of data mining tools.
- To identify the scope and essentiality of Data Warehousing and Mining
- Demonstrate the appropriate data mining techniques for decision making.
- To develop research interest towards advances in data mining.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to
1. Explain the basics of data mining techniques.
2. Identify the similarity and dissimilarity between the data sets.
3. Apply Data Preprocessing techniques.
4. Describe Data Warehouse fundamentals, Data Mining Principles.
5. Illustrate Multidimensional Data Analysis in Cube Space
6. Assess Mining Frequent Patterns, Associations, and Correlations

Unit I: Introduction: (Hours:7)
Why Data Mining? What Is Data Mining? , What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? , Which Kinds of Applications Are Targeted? , Major Issues in Data Mining.

Unit II: Getting to Know Your Data: (Hours:7)
Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

Unit III: Data Preprocessing: (Hours:7)
Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Unit IV: Data Warehousing and Online Analytical Processing: (Hours:7)
Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, data lake and Data Ocean.

Unit V: Data Cube Technology: (Hours:7)
Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queries by Exploring Cube Technology, Multidimensional Data Analysis in Cube Space.

Unit VI: Mining Frequent Patterns, Associations, and Correlations: (Hours:7)
Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods , Which Patterns Are Interesting?- Pattern Evaluation Methods .

Text Book:
Data Mining – Concepts and Techniques, Jiawei Han & Micheline Kamber, MorganKaufmann (MK) Publishers, Elsevier, 3rd Edition, 2006.

Reference Books:
1. Data Mining Techniques, Arun K Pujari, 3rd edition, Orient Blackswan/Universities Press,2013.
2. Data Warehousing Fundamentals, Paulraj Ponnaiah, John Wiley & Sons, 2001.
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, PearsonEducation, 2007
4. Insight into Data mining Theory and Practice, K.P. Soman, Shyam Diwakar and V. Ajay,Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition,Prentice Hall of India, 2006.

8KS03 Prof. Elect. V (iv) SYSTEM & SOFTWARE SECURITY

Course Prerequisite: Networking, Operating System, Basics of Cyber Security & Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate theirunderstanding of System and Software Security by being able to do each of the following:
1. To provide an in-depth study of concepts and threats in computer security.
2. To provide knowledge of common vulnerabilities, attack mechanisms and methods againstcomputer and information system
3. To familiarize security issues at various levels such as operating systems and databases.
4. To provide the study of vulnerability issues and its counter measures at advanced applicationsuch as networks and Clouds.

Course Outcomes (Expected Outcome): On completion of the course, the students will be ableto:
1. Relate malicious and non-malicious attacks.
2. Outline web common vulnerabilities, attack mechanisms and methods against computer andinformation systems.
3. Apply relevant methods for security modeling and analysis of Operating System.
4. Investigate a secure network by monitoring and analyzing the nature of attacks.
5. Explain cryptography, intrusion detection and firewall system
6. Implement different security solutions at various levels such as operating systems, databasesand clouds.

Unit I: (Hours7)
Programs and Programming: Unintentional (Non malicious) Programming: Buffer Overflow, Incomplete Mediation, Time-of-Check to Time-of Use, Undocumented Access Point, Off-by-One Error, Integer Overflow, Un-terminated Null-Terminated String, Parameter Length, Type and Number, Unsafe Utility Program, Race Condition. Malicious Code: Malware: Viruses, Trojan Horses, and Worms, Technical Details: Malicious Code. Countermeasures: Countermeasures for Users, Countermeasures for Developers, Countermeasure Specifically for Security, Countermeasures that Don’t Work.

Unit II: (Hours7)
The Web: Browser Attacks: Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication. Web Attacks Targeting Users: False or Misleading Content, Malicious Web Content, Protecting Against Malicious Web Pages. Obtaining User or Website Data: Code Within Data, Website Data: A User’s Problem, Too Foiling Data Attacks. Email Attacks: Fake Email, Fake Email Messages as Spam, Fake (Inaccurate) Email Header Data, Phishing, Protecting Against Email Attacks.

Unit III: (Hours7)

Operating System: Security in Operating Systems: Operating System Structure, Security Features of Ordinary Operating Systems, Protected Objects, Operating System Tools to Implement Security Functions. Security in the Design of Operating Systems: Simplicity of Design, Layered Design, Kernelized Design, Reference Monitor, Correctness and Completeness, Secure Design Principles,Trusted Systems, Trusted System Functions, The Results of Trusted Systems Research Rootkit: Phone Rootkit, Rootkit Evades Detection, Rootkit Operates Unchecked, Sony XCP Rootkit, TDSS Rootkits, Other Rootkits.

Unit IV: (Hours7)

Networks: Network Concepts, Threats to Network Communications: Interception: Eavesdropping and Wiretapping, Modification, Fabrication: Data Corruption Interruption: Loss of Service, Port Scanning, Vulnerability. Wireless Network Security: Vulnerabilities in Wireless Networks, Failed Countermeasure: WEP (Wired Equivalent Privacy), Stronger Protocol Suite: WPA (Wi-Fi Protected Access) Denial of Service, Cryptography in Network Security Browser Encryption, Onion Routing, IP Security Protocol Suite (IPsec), Virtual Private Networks, System Architecture. Firewalls: Firewall, Design of Firewalls, Types of Firewalls, Personal Firewalls Comparison of Firewall Types, Example Firewall Configurations.

Unit V: (Hours7)

Database: Security Requirements of Databases: Integrity of the Database, Element Integrity, Auditability, Access Control, User Authentication, Availability, Integrity / Confidentiality/Availability. Reliability and Integrity: Two-Phase Update Redundancy/Internal Consistency, Recovery, Concurrency/Consistency. Database Disclosure: Sensitive Data, Types of Disclosures, Preventing Disclosure: Data Suppression and Modification, Security Versus Precision Data Mining and Big Data: Data Mining, Big Data.

Unit VI: (Hours7)

Cloud Computing: Cloud Computing Concepts: Service Models, Deployment Models. Risk Analysis: Cloud Provider Assessment, Switching Cloud Providers, Cloud as a Security Control. Cloud Security Tools and Techniques: Data Protection in the Cloud, Cloud Application Security, Logging and Incident Response. Cloud Identity Management: Security Assertion Markup Language OAuth: OAuth for Authentication. Securing IaaS.

Text Book:

Security in Computing, Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, FifthEdition, Prentice Hall, 2015.

Reference Books:

1. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, Third Edition,Pearson Prentice Hall
2. Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing Achyut S.Godbole,Tata McGraw-Hill Education, 2013
3. Cryptography and Network Security Principles and Practices, William Stallings, SeventhEdition, Pearson
4. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, AddisonWesley, 2011

8KS03 PE V: (ii) MACHINE LEARNING AND AI

Course Prerequisite: Basic Mathematics, Linear algebra, Vectors and matrices, Data Science &Statistics

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding ofMachine Learning and AI by being able to do each of the following:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand neural network

Course Outcomes (Expected Outcome):

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

1. Describe Machine learning and its types.
2. Discuss Bayesian Decision Theory and Parametric Methods
3. Illustrate Multivariate and Dimensionality Reduction methods.
4. Categorize Non-Parametric methods.
5. Justify discrimination techniques in Machine learning.
6. Synthesize Neural network using Multilayer Perceptron.

Unit I: (Hours7)

Multilayer Perceptions: Introduction: Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing; The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptron's, MLP as a Universal Approximator, Back propagation Algorithm: Nonlinear Regression, Multiple Hidden Layers.

Unit II: (Hours7)
Introduction: What Is Machine Learning Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning Supervised Learning, Vapnik Chervonenk is Dimension, Dimensions of a Supervised Machine Learning Algorithm.

Unit III: (Hours7)
Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Evaluating an Estimator: Bias and Variance, Tuning ModelComplexity: Bias/Variance Dilemma, Model Selection Procedures

Unit IV: (Hours7)
Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis, FeatureEmbedding, Factor Analysis.

Unit V: (Hours7)
Clustering: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters, Condensed Nearest Neighbor, Distance-Based Classification, Outlier Detection.

Unit VI: (Hours7)
Decision Trees: Introduction, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees. Linear Discrimination: Introduction, Generalizing the Linear Model.

Text Book:
Ethem Alpaydin, -Introduction to Machine Learning 3e (Adaptive Computation and MachineLearning Series), Third Edition, MIT Press, 2014

Reference Books:
1. Stephen Marsland, -Machine Learning – An Algorithmic Perspective‖, Second Edition,Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, -Machine Learning‖, First Edition, McGraw Hill Education, 2013.
3. Peter Flach,Machine Learning: The Art and Science of Algorithms that Make Sense ofData‖, First Edition, Cambridge University Press, 2012.

8KS04 Prof. Elect. VI (ii) MULTIMEDIA COMPUTING

Course Prerequisite: Computer Network, Image Processing

Course Objectives: Throughout the course, students will be expected to demonstrate theirunderstanding of Multimedia Computing by being able to do each of the following:

1. To learn and understand technical aspect of Multimedia Computing.
2. To understand the standards available for different audio video and text applications.
3. To Design and develop various Multimedia Systems applicable in real time.
4. To learn various multimedia compression algorithms.
5. To understand various networking aspects used for multimedia applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be ableto
1. Describe technical aspect of Multimedia Computing.
2. Compare various file formats for audio, video and text media.
3. Examine lossless data compression techniques in real time.
4. Illustrate lossy data compression techniques in real time scenario
5. Investigate video compression technique
6. Construct various networking protocols for multimedia applications.

Unit I: Introduction: (Hours7)
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web,overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Unit II: Video and Digital Audio: (Hours7)
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Unit III: Data Compression-I: (Hours7)
Multimedia data compression I: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression.

Unit IV: Data Compression-II: (Hours7)
Multimedia data compression II: Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Unit V: Video Compression: (Hours7)
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

Unit VI: Multimedia Networks: (Hours7)
Basics of Multimedia Networks, Multimedia Network Communications and Applications: Qualityof Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

Text Book: Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew Pearson Education.

Reference Books:
1. Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech
2. Macromedia Flash MX Professional 2004 Unleashed, Pearson.
3. Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press).
4. Multimedia Applications, Steinmetz, Nahrstedt, Springer.
5. Multimedia Technology and Applications, David Hilman, Galgotia.

3KE02 DISCRETE MATHEMATICS

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:
1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3.. Apply logical reasoning to solve a variety of problem

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Perform operation on trees data structures.
6. Develop the given problem as graph networks and solve with techniques of graph theory.

Unit I: The Foundations: Logic and Proofs: (**Hours: 8**)
Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments.

Unit II: Sets, Functions and Relation: (**Hours: 8**)
Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations ,Functions, Inverse Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations.

Unit III: Algebraic Structures: (**Hours: 8**)
Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.

Unit IV: Boolean Algebra: **(Hours: 7)**
Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.

Unit V: Tree: **(Hours: 7)**
Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, Inorder Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree

Unit VI: Graph: **(Hours: 7)**
Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings;

Text Books:

[1] Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.

[2] J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.

Reference Books:

[1] Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.

[2] Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.

[3] C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill

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4KE02 COMPUTER NETWORKS

Course Pre-requisite: Computer and Data Communication Requirements

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Communication and Networking by being able to do each of the following:

1. Study the basic taxonomy and terminology of the digital communication system & computer networking and enumerate the layers of OSI model and TCP/IP model.
2. Acquire knowledge of Application layer paradigms and protocols.
3. Study Transport layer design issues, Transport layer services, and protocols.
4. Gain core knowledge of Network layer routing protocols and IP addressing.
5. Study data link layer concepts, design issues, and protocols.
6. Study various network security issues and firewalls.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe the functions of each layer in OSI and TCP/IP model.
2. Describe the Transport layer and Transport layer services.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Explain the functions of Application layer and Presentation layer paradigms and Protocols.
5. Describe the functions of data link layer and explain the protocols.
6. Explain the types of transmission media with real time applications.

Unit I: Introduction: (Hours: 7)

Introduction: Data Communication, Components, Networks, Network types, Switching, The Internet, Accessing the Internet, Internet Standards & Administration.

UNIT II: Network Models: (Hours 7)

Layered architecture, TCP/IP Protocol Suite, The OSI Model, Transmission media: Introduction, Guided media & Unguided Media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit III: Application Layer: (Hours: 7)

Introduction to Application layer, Application-Layer Paradigms & Services, Client-Server Programming, Application Programming Interface, Principles of Application-Layer protocols: HTTP, FTP, SMTP and DNS.

Unit IV: Transport Layer: (Hours: 7)

Introduction to Transport layer, Transport Layer services & principles, multiplexing & de-multiplexing applications, Connectionless and Connection Oriented Protocols, UDP Protocol, principles of reliable data transfer, TCP Protocol, principles of congestion control, TCP congestion control, Flow Control, Error Control.

Unit V: Network Layer: (Hours: 6)

Introduction to Network layer, Network Layer Services, Datagram & Virtual-Circuit Approach, Network Layer performance, IPV4 Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets, Internet Protocol (IP), Datagram Format, Fragmentation, ICMPV4: Messages, ICMP Checksum, Routing algorithms: Distance Vector routing & Link State Routing, IPV6 Addressing, Transition from IPV4 to IPV6.

Unit VI: Link Layer: (Hours: 6)

Introduction to Link Layer, Link layer Services, Categories of links, Error detection and correction: Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC), LAN addresses & ARP, CSMA / CD, PPP details.

Text Books:

[1] Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH)

[2] James F. Kurose & K W Ross: Computer Networking, Pearson Education (LPE)

Reference Books:

[1] William Stallings: Data & Computer Communications, 6/e, Pearson Education
[2] William L. Schweber : Data Communication, McGraw Hill
[3] Douglas E. Comer: Computer Network & Internet, Addison Wesley.
[4] Andrew S. Tanenbaum: Computer Networks, PHI (5E)
[5] Leon Garcia & Widjaja: Communication Networks, TMH.

(ii) Substitution of Text Books & Reference Books for the subject 8KS02 Professional Ethics and Management

8KS02 PROFESSIONAL ETHICS AND MANAGEMENT

Text Books:

1. D G Harkut and G R Bamnote "Professional Ethics for Engineers", Notion Press, India.
2. Prof. Susmita Mukhopadhyay, 'Ethics in Engineering Practice' IIT Kharagpur.

Reference Books:

1. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', Tata Mc-Graw Hill, New York,2005.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, 'Engineering Ethics –Concepts and Cases', Cengage Learning, 2009 & Thompson Learning, 2000.
3. Govindarajan M., Natarajan, 'Engineering Ethics', Prentice Hall of India, New Delhi, 2004.
4. Stephen Byars, 'Business Ethics', USC Marshal School of Business Kurt Stanberry, University of Houston (https://openstax.org/details/books/business-ethics.

Sd/-
(Dr.T.R.Deshmukh)
Registrar

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