SREE VIDYANIKETHAN ENGINEERING COLLEGE

(AUTONOMOUS)

Sree Sainath Nagar, Tirupati

Department of Computer Science and Engineering

Supporting Document for 1.1.2

Syllabus Revision carried out in 2019

Program: M.Tech.- Computer Networks and Information Security

Regulations : SVEC-19

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note: *For SVEC-19 revised syllabus, SVEC-16 (previous syllabus) is the reference.*

List of Courses where syllabus content has been changed (20% and more)

S. No.	Course Code	Name of the course	Percentage of content changed	Page Number in which Details are Highlighted
1.	19MT10501	Advanced Algorithms	100	1
2.	19MT10502	Advanced Data Structures	100	2
3.	19MT10503	Mathematical Foundations of Computer Science	100	3
4.	19MT10504	Artificial Intelligence	100	4
5.	19MT10505	Data Warehousing and Data Mining	25.5	5
6.	19MT16302	Network Intrusion Detection Systems	100	8
7.	19MT10509	Machine Learning	100	11
8.	19MT16303	Cloud Computing	26.6	12
9.	19MT16305	Malware and Risk Analysis	100	15
10.	19MT10531	Advanced Algorithms Lab	100	16
11.	19MT10532	Advanced Data Structures Lab	100	17
12.	19MT1AC01	Technical Report Writing	100	18
13.	19MT26301	Cryptography and Network Security	37.7	19
14.	19MT26302	Wireless Sensor Networks	100	22
15.	19MT20503	Artificial Neural Networks and Deep Learning	100	23
16.	19MT26304	GPU Computing	100	24
17.	19MT26305	Internet of Things	26.6	25
18.	19MT20508	Soft Computing	100	26
19.	19MT26306	Block chain Technologies	100	29
20.	19MT26307	Secure Software Design and Enterprise Computing	100	30
21.	19MT26308	Software Defined Networks	100	31
22.	19MT26331	Cryptography and Network Security Lab	72.7	32
23.	19MT26332	Wireless Sensor Networks Lab	100	35
24.	19MT2AC01	Statistics with R	100	36
		Average %**(A)**	87.05	
		Total No. of Courses in the Program **(T)**	48	
		No. of Courses where syllabus (more than 20% content) has been changed **(N)**	24	-
		Percentage of syllabus content change in the courses **(C)=(A x N)/100**	20.89	
		Percentage of Syllabus Content changed in the Program (P)= C/T	**43.52**	

DEAN (Academics)

DEAN (Academic)
SREE VIDYANIKETHAN ENGINEERING COLLEGE
Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

PRINCIPAL

PRINCIPAL
SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, A. RANGAMPET
Chittoor (Dist.) - 517 102, A.P., INDIA

M. Tech. (CNIS) - I Semester
(19MT10501) ADVANCED ALGORITHMS
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Design and Analysis of Algorithms.

COURSE DESCRIPTION:
Introduction to algorithm design techniques; Divide and conquer, greedy methods and dynamic programming; Backtracking, branch and bound techniques and NP-completeness; Methods of advanced graph theory; approximation algorithms and number theoretic algorithms; max flow and string matching algorithms and randomizing algorithms.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Perceive and apply the concepts of different algorithmic techniques to find solutions for a specific problem.
CO2. Design solutions for societal problems by applying the concepts from dynamic programming, backtracking.

DETAILED SYLLABUS:

UNIT-I: The Role of Algorithms in Computing, Divide and Conquer, Greedy Methods (8 Hours)
The Role of Algorithms in Computing: Algorithms, Analyzing algorithms, Designing algorithms, Asymptotic notations.
Divide and Conquer: General method, Binary search, The maximum sub-array problem.
Greedy Method: General method, Job sequencing with deadlines, Knapsack problem, Huffman codes.

UNIT-II: Dynamic Programming, Back Tracking, Branch and Bound (10 Hours)
Dynamic Programming: Optimal binary search trees, 0/1 Knapsack problem, Traveling sales person problem.
Back Tracking: N–Queen's problem, Graph coloring, Sum of subsets problem, Hamiltonian cycles.
Branch and Bound: LC Search, LIFO and FIFO branch and bound solutions of 0/1 Knapsack problem.

UNIT-III: NP-Completeness and Approximation Algorithms (9 Hours)
NP-Completeness: Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems.
Approximation Algorithms: The vertex-cover problem, The traveling salesman problem, The set-covering problem, The subset-sum problem.

UNIT-IV: Max Flow and Number Theoretic Algorithms (9 Hours)
Max Flow: Flow networks, Ford-Fulkerson method, Maximum Bi-partite matching.
Number Theoretic Algorithms: Elementary number theoretic notions, Greatest common divisor, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem.

UNIT-V: String Matching Algorithms, Probabilistic and Randomized Algorithms (9 Hours)
String Matching: The Naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm.
Randomizing Deterministic Algorithms: Monte Carlo and Las Vegas algorithms, Probabilistic numeric algorithms.

Total Hours: 45

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, PHI Learning, 3rd Edition, 2009.
2. Ellis Horowitz, Sartaj Sahni, and S Rajasekaran, *Fundamentals of Computer Algorithms*, Universities Press, 2nd Edition, 2008.

REFERENCE BOOKS:

1. Michael T. Goodrich, Roberto Tomassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, Wiley, 2002.
2. Adrian J., Bondy, U.S.R.Murty, *Graph Theory*, Springer, 2008.

M. Tech. (CNIS) – I Semester
(19MT10502) ADVANCED DATA STRUCTURES
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer Programming and Data Structures.

COURSE DESCRIPTION:
Introduction to elementary data structures including stacks, queues, and lists, analysis of algorithms and recurrences, Trees and Graphs, Skip lists, Computational Geometry, Heap and Hash tables.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Develop appropriate data structures for efficient storage and retrieval of data.
CO2. Choose appropriate data structures, understand the ADT/libraries, and use it to solve a specific problem.

DETAILED SYLLABUS:

UNIT-I: Introduction to Data Structures **(9 Hours)**
Introduction to Data Structures: Types of data structures, time and space complexity, Asymptotic notations.
Recurrences: The substitution method, Recurrence tree method, Master's theorem for solving recursions.
Elementary data structures: Stacks and its applications, Queues - Circular Queue, Dequeue, applications; Linked lists implementations and its types.

UNIT-II: Trees **(10 Hours)**
Trees: Representation and applications of trees, Binary trees, Expression trees, Binary Search Trees, AVL Trees, Red Black Trees, B-Trees, Splay Trees, Sets and maps implementation.

UNIT-III: Graphs and Skip Lists **(10 Hours)**
Graphs: Basic terminologies of graphs, Representation and applications, Graph traversal techniques, Minimum spanning trees, Maximum Bipartite Matching, Minimum cost flow.
Skip Lists: Need for Randomizing data structures and algorithms, Search and update operations on skip lists, Probabilistic analysis of skip lists, Deterministic skip lists.

UNIT-IV: Heaps and Hash Tables **(9 Hours)**
Heaps: Definition, Heap Implementation, priority queues, Applications, Binomial heaps, operations on binomial heaps, Fibonacci heaps, Mergeable heap operations, decreasing a key and delete a node, Bounding a maximum degree.
Hashing: Definition, Hash functions and problems, Collision resolution techniques, Universal hashing, Applications.

UNIT-V: Computational Geometry **(7 Hours)**
One dimensional range searching, Two dimensional range searching, Constructing a priority search tree, Searching a priority search tree, Priority range trees, Quad trees, k-D Trees.

Total Hours: 45

TEXT BOOKS:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, Pearson, 4th Edition, 2014.
2. Michael T. Goodrich, Roberto Tomassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, Wiley, 2002.

REFERENCE BOOKS:

1. Sartaj Sahni, *Data Structures, Algorithms and Applications in C++*, Universities Press, 2nd Edition, 2005.
2. Richard F. Gilberg, Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, Cengage, 2nd Edition, 2007.

M. Tech. (CNIS) - I Semester

(19MT10503) MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Multivariable Calculus and Differential Equations.

COURSE DESCRIPTION:
Mathematical Logic, Predicate calculus, Set theory, Relations, functions, Algebraic Structures, Combinations and Permutations, Recurrence Relations, Graph Theory and its Applications.

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

CO1. Understand and apply the fundamental concepts of mathematical logic to solve engineering problems.

CO2. Formulate problems and solve using recurrence relations and graph theory.

DETAILED SYLLABUS:

UNIT-I: Mathematical Logic and Predicate Calculus **(9 Hours)**

Mathematical Logic: Introduction, Statements and notations, Connectives, Truth tables, Tautology, Tautological implications, Well formed formulae, Other connectives, Normal forms, The theory of inference for the statement calculus, Automatic theorem proving.

Predicate Calculus: Predicates, Quantifiers, Predicate formulas, Free and bound variables, The universe of discourse, Theory of inference for the predicate calculus.

UNIT-II: Set Theory and Algebraic Structures **(9 Hours)**

Set Theory: Basic concepts of set theory, Relations, Properties of binary relation, Relation matrix and the graph of a relation, Equivalence relations, Compatibility relations, Partial ordering, Partially ordered set, Functions - Definition and introduction, Composition of function, Inverse function.

Algebraic Structures: Algebraic systems, Semigroups and monoids, Groups, Homomorphism and isomorphism, Cosets and Lagrange's theorem.

UNIT-III: Elementary Combinatorics **(9 Hours)**

Basics of counting, Combinations and permutations, Enumeration of combinations and permutations, Enumerating combinations and permutations with and without repetitions, The binomial and multinomial Theorems, The principle of inclusion exclusion, Pigeon hole principle.

UNIT-IV: Recurrence Relations **(9 Hours)**

Generating functions of sequences, Calculating coefficients of generating functions, Recurrence relations, Solving recurrence relations by substitution and generating functions, The method of characteristic roots, Solutions of inhomogeneous recurrence relations.

UNIT-V: Graph Theory and Its Applications **(9 Hours)**

Introduction, Isomorphism and sub graphs, Trees and their properties, Spanning trees, Planar graphs, Euler's formula, Multigraphs and Euler circuits, Hamiltonian graphs and circuits, Chromatic number, The four-color problem.

Total Hours: 45

TEXT BOOKS:

1. J. P. Tremblay, R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Mc Graw Hill, 2008.
2. Joe L. Mott, Abraham Kandel, Theodore P. Baker, *Discrete Mathematics for Computer Scientists and Mathematicians*, Pearson, 2nd Edition, 2008.

REFERENCE BOOKS:

1. John Vince, *Foundation Mathematics for Computer Science: A Visual Approach*, Springer, 2015.
2. K.H. Rosen, *Discrete Mathematics and its Applications*, McGraw Hill, 7th Edition, 2012.

M. Tech. (CNIS) - I Semester
(19MT10504) ARTIFICIAL INTELLIGENCE
(Program Elective -1)
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Mathematical Foundations of Computer Science and Data Structures.

COURSE DESCRIPTION:
Artificial intelligence concepts, Intelligent agents, Problem solving agents, Logical agents, Knowledge representation and processing, Probabilistic learning, Natural language processing.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Apply knowledge of artificial intelligence techniques to develop an intelligent system for a given problem.
CO2. Design and develop solutions for natural language processing applications.

DETAILED SYLLABUS:

UNIT-I: Introduction **(9 Hours)**
AI Definition, Foundations of artificial intelligence, State of the art.
Intelligent Agents - Agents and environments, The concept of rationality, Nature of environments, Structure of agents.

UNIT-II: Problem Solving **(9 Hours)**
Problem solving agents, Searching for solutions, Uninformed search strategies, Informed search strategies, Heuristic functions, Local search algorithms and optimization problems.

UNIT-III: Logical Agents **(9 Hours)**
Knowledge based agents, The Wumpus World, Logic, Propositional logic, Propositional theorem proving.
First Order Logic - Syntax and semantics of first-order logic, Using first order logic, Knowledge engineering.

UNIT-IV: Knowledge Representation and Probabilistic Learning **(9 Hours)**
Ontological engineering, Categories and objects, Events, Mental events and mental objects, Reasoning systems for categories, Reasoning with default information, The Internet shopping world, Knowledge representation in uncertain domain, Bayesian networks, Independence, Bayes' rule.

UNIT-V: Probabilistic Reasoning over Time **(9 Hours)**
Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman filters, Dynamic Bayesian networks, Multi object tracking.
Natural Language Processing - Language models, Text classification, Information retrieval, Machine translation, Speech recognition.

Total Hours: 45

TEXT BOOK:
1. Stuart J. Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson, 3rd Edition, 2010.

REFERENCE BOOKS:
1. Elaine Rich, Kevin Knight, B. Shivashankar B. Nair, *Artificial Intelligence*, McGraw Hill, 3rd Edition, 2017.
2. Saroj Kaushik, *Artificial Intelligence*, Cengage Learning, 1st Edition, 2011.

M. Tech. (CNIS) – I Semester
(19MT10505) DATA WAREHOUSING AND DATA MINING
(Program Elective – 1)
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Database Management Systems.

COURSE DESCRIPTION:
Introduction to Data warehousing and OLAP with its operations, Need for data pre-processing and pre-processing techniques, Functionalities of Data mining, Classification, Association pattern mining, Cluster analysis, Trends in Data mining.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Identify the key concepts of data warehousing and design data warehouses to support OLAP applications.
CO2. Analyze and preprocess various datasets to improve the quality of data in the process of knowledge discovery.
CO3. Choose and apply appropriate data mining techniques for the given datasets to generate patterns, visualize and analyze patterns to discover actionable knowledge.

DETAILED SYLLABUS:

UNIT-I: Data Warehousing and Online Analytical Processing (9 Hours)
Data warehouse, Operational database systems versus data warehouses, A Multi-tiered architecture, A Multidimensional data model, Star, Snowflake and Fact Constellation schemas, Role of concept hierarchies, Measures, OLAP operations, From online analytical processing to multidimensional data mining, Indexing OLAP data.

UNIT-II: Data Mining and Data Preprocessing (8 Hours)
Introduction to data mining, Kinds of data, Kinds of patterns, Major issues in data mining, Data pre-processing, Data cleaning, Data integration, Data reduction, Data transformation and discretization.

UNIT-III: Associations And Classification (10 Hours)
Basic concepts, Frequent itemset mining methods, Pattern evaluation methods, From association mining to correlation analysis, Classification, Decision tree induction, Bayesian classification methods, Rule based classification, Prediction - linear regression.

UNIT-IV: Cluster Analysis (9 Hours)
Types of data in cluster analysis, A categorization of major clustering methods, Partitioning Methods - K-Means, K-Medoids; Hierarchical methods - Agglomerative method, Divisive method; Density based method - DBSCAN; Grid based method - STING; Outlier analysis.

UNIT-V: Data Mining Trends (9 Hours)
Mining sequence data, Mining graphs and networks, Spatial data mining, Text mining , Mining multimedia and web data, Statistical data mining, Privacy security and social impacts of data mining, Social network analysis.

Total Hours: 45

TEXT BOOK:
1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining: Concepts and Techniques*, Elsevier, 3rd Edition, 2013.

REFERENCE BOOKS:
1. Mohammed J. Zaki, Wagner Meira Jr., *Data Mining and Analysis: Fundamental Concepts and Algorithms*, Cambridge University Press, 2014.
2. Pang-Ning Tan, Vipin Kumar, Michael Steinbach, *Introduction to Data Mining*, Pearson, 2nd Edition, 2019.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M. Tech (CN&IS)I-Semester

(16MT10504) DATA WAREHOUSING AND DATA MINING

(Common to CS and CN&IS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	--	4

PRE-REQUISITES:

A course on "Database Management Systems"

COURSE DESCRIPTION

Concepts of Data Warehousing and Data Mining; Pre-processing Techniques in Data Warehouses; Data cube computation and OLAP query processing; Data Mining process and System architecture; relationship with data warehouse and OLAP Systems; Data mining Techniques and Applications

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

CO1. Gain knowledge in:

- Multidimensional data model and Data Warehouse architectures. .
- Data mining algorithms.
- Association Rules, Classification and Prediction and Cluster Analysis.

CO2. Analyse data mining algorithms for complex industrial problems.

CO3. Solve engineering problems to get wide variety of solutions by applying data mining algorithms.

CO4. Ability to carry out research in spatial mining, spatio temporal mining, text mining, multimedia and web mining

CO5. Create and apply appropriate techniques & tools of data mining to solve real world problems

DETAILED SYLLABUS:

UNIT I – INTRODUCTION TO DATA WAREHOUSE AND DATA MINING

(10 periods)

Data Warehouse- A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehouse to Data Mining.

Data Mining – Kinds of Data, Data Mining Functionalities, Primitives, Major Issues in Data Mining

UNIT II – DATA PREPROCESSING, MINING FREQUENT PATTERNS AND ASSOCIATIONS (10 periods)

Data Preprocessing- Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction.

Mining Frequent Patterns and Associations- Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, Constraint based association mining.

UNIT III – CLASSIFICATION AND PREDICTION (8 p*eriods*)

Issues regarding classification and prediction, classification by decision tree induction, Bayesian classification, Rule based classification, classification by Back propagation, Prediction, Accuracy and Error Measures.

UNIT IV – CLUSTER ANALYSIS (11 periods)

Cluster Analysis: Basic Concepts and Algorithms : introduction to Cluster Analysis, Different Types of Clustering, Different Types of Clusters, K-means, The Basic K-means Algorithm, K-means: Additional Issues, Bisecting K-means, K-means and Different Types of Clusters, Strengths and Weaknesses, K-means as an Optimization Problem, Agglomerative Hierarchical Clustering, Basic Agglomerative Hierarchical Clustering Algorithm, Specific Techniques, DBSCAN, Traditional Density: Center-Based Approach, The DBSCAN Algorithm, Strengths and Weaknesses.

UNIT V – MINING STREAM, TIME SERIES, SPATIAL DATA, MULTIMEDIA, TEXT AND WORL WIDE WEB (9 p*eriods*)

Mining Data Streams, Mining Time Series Data, Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Total Periods: *48*

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, "*Data Mining: Concepts and Techniques*," 2ed, Elsevier, 2009
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "*Introduction to Data Mining*", Pearson Education,2009.

REFERENCE BOOKS:

1. Margaret H Dunham, *Data Mining Introductory and Advanced Topics*," 2ed, Pearson Education, 2006
2. Amitesh Sinha, "*Data Warehousing*," PHI Learning, 2007

M. Tech. (CNIS) – I Semester
(19MT16302) NETWORK INTRUSION DETECTION SYSTEMS
(Program Elective - 1)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer Networks and Network Security.

COURSE DESCRIPTION: Introduction to network anomalies, An overview of machine learning methods, Detecting anomalies in network data, Feature selection, Approaches to network anomaly detection, Evaluation methods, Tools and systems.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Understand the machine learning methods and feature selection to analyze and detect network anomalies.
CO2. Use various tools and systems for attack detection in computer networks.

DETAILED SYLLABUS:

UNIT-I: Networks and Anomalies **(9 Hours)**
Networking Basics: Communication media, Network software, Reference models, protocols, Types of networks, Network topologies, Hardware components, Network performance.
Anomalies in a Network: Network vulnerabilities, Security-related network anomalies, Who attacks networks, Precursors to an attack, Network attacks taxonomy.

UNIT-II: Machine Learning Methods and Detecting Anomalies in Network Data **(9 Hours)**
Overview of Machine Learning Methods: Supervised learning, Unsupervised learning, Probabilistic learning, Soft computing, Reinforcement learning, Hybrid learning methods.
Detecting Anomalies in Network Data: Detection of network anomalies, Aspects of network anomaly detection, Datasets.

UNIT-III: Feature Selection and Approaches to Network Anomaly Detection **(11 Hours)**
Feature Selection: Feature selection vs. feature extraction, Relevance, Advantages, Applications, Prior surveys on feature selection, Problem formulation, Steps in feature selection, Existing methods of feature selection, Subset evaluation measures, Systems and tools for feature selection.
Approaches to Network Anomaly Detection: Network anomaly detection methods, Types of network anomaly detection methods, Anomaly detection using supervised learning, Anomaly detection using unsupervised learning, Anomaly detection using probabilistic learning, Anomaly detection using soft computing, Knowledge in anomaly detection, Anomaly detection using combination learners.

Unit-IV: Evaluation Methods **(8 Hours)**
Accuracy, Performance, Completeness, Timeliness, Stability, Interoperability, Data quality, Validity and reliability, Alert information, Unknown attacks detection, Updating references.

UNIT-V: Tools and Systems **(8 Hours)**
Attacker's motivation, Steps in attack launching, Launching and detecting attacks, Attack related tools, Attack launching tools, Network monitoring tools, Attack detection systems.

Total Hours: 45

TEXT BOOK:
1. Dhruba Kumar Bhattacharyya, Jugal Kumar Kalita, *Network Anomaly Detection: A Machine Learning Perspective*, CRC Press, 2014.

REFERENCE BOOKS:
1. Stephen Northcutt, Judy Novak, *Network Intrusion Detection*, New Riders Publishing, 3rd Edition, 2002.
2. Carl Endorf, Eugene Schultz and Jim Mellander, *Intrusion Detection and Prevention*, McGraw Hill, 2004.
3. Earl Carter, Jonathan Hogue, *Intrusion Prevention Fundamentals*, Pearson Education, 1st Edition, 2002.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M. Tech (CN&IS) II-Semester

(16MT26301) INTRUSION DETECTION SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	*60*	*100*	*4*	*--*	*--*	*4*

PRE-REQUISITES:

Courses on "Computer Networks" and "Network security"

COURSE DESCRIPTION:

Introduction to threats , attacks and intrusions; Network security monitoring and Sinkhole design; Traffic threat assessment and network incident response; Malicious bots and botnet construction; introduction to network forensics and Intrusion prevention systems(IPS) in host and network level.

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

CO1: Gain Knowledge on Intrusions, security monitoring, Network Forensic principles and Intrusion Prevention system (IPS).

CO2: Analyze the threats and vulnerabilities in the network traffic for designing the solutions.

CO3: Detect, identify and mitigate the security attacks from the network traffic to provide the solutions to the real word problems.

CO4: Conduct research to identify novel solutions for detecting and mitigation of Intrusions in public and private networks.

CO5: Gain exposure on IDS and IPs tools of Intrusion and Extrusion detection for NSM data collections.

DETAILED SYLLABUS:

UNIT I: NETWORK SECURITY MONITORING REVISITED AND EXTRUSION DETECTION ILLUSTRATED (12 periods)

Network Security Monitoring Revisited: Defining the security process, Principles, Network security monitoring (NSM) Theory, Techniques and tools. Defensible Network Architecture- Defensible network Monitoring, Controlling, Minimizing and current.

Extrusion Detection Illustrated: Definition of Intrusion detection, Definition of Extrusion detection, History of Extrusion detection and Extrusion detection through NSM

UNIT II LAYER-3 NETWORK ACCESS CONTROL AND TRAFFIC THREAT ASSESSMENT (10 periods)

Layer-3 Network Access Control: Internal network Design, ISP sink holes, Enterprise sink holes and Internal intrusion containment.

Traffic Threat Assessment: Assumptions, First cuts, looking for odd traffic, Inspecting individual services through NTP, ISAKMP, ICMP, Secure shell, WhoIs, LDAP, other ports.

UNIT III : NETWORK INCIDENT RESPONSE AND NETWORK FORENSICS (11 p*eriods*)

Network Incident Response: Preparation for network incident response, Secure CSIRT communication, Intruder Profiles, Incident Detection Methods, Network First Response, Network-Centric General Response and Remediation.

Collecting network traffic as evidence, protecting and preserving network based evidence, Analyzing network based evidence, presenting and defending conclusions.

UNIT IV : MALICIOUS BOTS AND INTRUSION PREVENTION OVERVIEW (11 periods)

Traffic Threat Assessment Case Study, Malicious Bots: IRC bots, communication and identification, server and control channels, exploitation and bot admin.

Intrusion Prevention Overview, Signatures and Actions: Types, Triggers and actions, Operational Tasks: deploying & configuring IPS devices and applications, Monitoring IPS activities, Securing IPS communications

UNIT V: HOST INTRUSION PREVENTION AND NETWORK INTRUSION PREVENTION (11 p*eriods*)

Host Intrusion Prevention Overview, Capabilities, Benefits, Limitations, HIPS Components: End agents, Gathering data about the operation, state, security policy and Infrastructure.

Network Intrusion Prevention Overview, Capabilities, Benefits, Limitations, NIPS Components: Capturing, Analyzing, Responding to Network Traffic, Sensor management and Monitoring.

Total Periods: 55

TEXT BOOKS:

1. Richard Bejtlich, "*Extrusion Detection: Security Monitoring for Internal Intrusions*," 1ed. Pearson Education, New Delhi, 2004.
2. Earl Carter, Jonathan Hogue, "*Intrusion Prevention Fundamentals*," 1ed, Pearson Education, New Delhi, 2002.

REFERENCE BOOKS:

1. Carl Endorf, Eugene Schultz and Jim Mellander, "*Intrusion Detection and Prevention*," McGraw-Hill, 2004
2. Stephen Northcutt, Judy Novak, "*Network Intrusion Detection*," New Riders Publishing, 3ed, 2002

M. Tech. (CNIS) – I Semester
(19MT10509) MACHINE LEARNING
(Program Elective – 2)
(Common to CS, CNIS and SE)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on statistics.

COURSE DESCRIPTION:
Concepts of supervised, unsupervised and reinforcement learning, Bayesian decision theory, Learning rules from data, Performance evaluation of classification algorithms, Ensemble learners, Elements of Reinforcement Learning.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Understand, select and apply appropriate machine learning strategies of supervised, unsupervised and reinforcement learning for solving a given problem.
CO2. Evaluate the performance of machine learning algorithms and select optimal models to suit needs of a given problem.
CO3. Redesign existing machine learning algorithms to improve efficiency of classification models.

DETAILED SYLLABUS:

UNIT-I: Introduction **(9 Hours)**
Machine Learning, Applications, Supervised Learning - Learning a class from examples, Vapnik Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Noise, Learning multiple classes, Regression, Model selection and generalization.

UNIT-II: Bayesian Decision Theory and Linear Discrimination **(9 Hours)**
Bayesian Decision Theory: Classification, Losses and risks, Discriminant functions, Utility theory, Value of information, Bayesian networks, Influence diagrams, Association rules.
Linear Discrimination: Generalizing linear model, Geometry of the linear discriminant, Pairwise separation, Parametric discrimination, Gradient descent, Support vector machines.

UNIT-III: Decision Trees and Clustering **(9 Hours)**
Decision trees: Univariate trees, Pruning, Rule extraction from trees, Learning rules from data, Multivariate trees.
Clustering: Mixture densities, K-Means clustering, EM algorithm, Supervised learning after clustering, Hierarchical clustering, Choosing the number of clusters.

UNIT-IV: Performance Evaluation of Classification Algorithms **(9 Hours)**
Cross validation and resampling methods, Measuring error, Interval estimation, Hypothesis testing, Assessing a classification algorithm's performance, Comparing two classification algorithms.
Combining Multiple Learners: Rationale, Voting, Bagging, Boosting, The mixture of experts revisited, Stacked generalization, Cascading.

UNIT-V: Reinforcement Learning **(9 Hours)**
Single state case - *K*-Armed Bandit; Elements of reinforcement learning, Model based learning, Temporal difference learning, Generalization, Partially observable states.

Total Hours: 45

TEXT BOOK:
1. Ethem Alpaydin, *Introduction to Machine Learning,* MIT Press (Adaptive Computation and Machine Learning Series), 3rd Edition, 2014.

REFERENCE BOOKS:
1. Stephen Marsland, *Machine Learning: An Algorithmic Perspective*, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2nd Edition, 2014.
2. Richard O. Duda, Peter E. Hart, David G. Stork, *Pattern Classification*, Wiley, 2nd Edition, 2012.

M. Tech. (CNIS) – I Semester
(19MT16303) CLOUD COMPUTING
(Program Elective – 2)
(Common to CNIS, CS and SE)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer Networks and Operating Systems.

COURSE DESCRIPTION:
Characteristics and taxonomy of virtualization techniques, Cloud services, Cloud architecture - NIST and other models, communication protocols, and applications, Cloud programming concepts - concurrent programming, task programming, data intensive computing,; Trends and industrial platforms.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Create virtual environments to deploy cloud services by using the concepts of virtualization and cloud computing.
CO2. Analyze and deploy cloud architectures for providing cloud services to cater needs of diverse applications.

DETAILED SYLLABUS:

UNIT-I: Introduction to Virtualization **(9 Hours)**
Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples - XEN, VMware, Microsoft Hyper-V.

UNIT-II: Fundamental Cloud Computing **(9 Hours)**
Understanding Cloud Computing - Origins and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges; Fundamental concepts and models - Roles and boundaries, Cloud characteristics, Cloud delivery models, Cloud deployment models; Cloud enabling technology - Broadband networks and Internet architecture, Data center technology; Fundamental cloud security - Basic terms and concepts, Threat agents, Cloud security threats, Additional considerations.

UNIT-III: Defining Cloud Services **(9 Hours)**
Defining Infrastructure as a Service (IaaS) - IaaS workloads, Pods, Aggregation, and silos; Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS) - SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS; Defining Identity as a Service (IDaaS) - Introduction to identity, Networked identity service classes, Identity system codes of conduct, IDaaS interoperability; Defining Compliance as a Service (CaaS).

UNIT-IV: Cloud Programming Concepts **(9 Hours)**
Concurrent programming - Introduction to parallelism for single machine computation, Programming applications with threads; High throughput computing - Task programming, Task based application models; Data intensive computing - Introduction to data intensive computing and technologies for data intensive computing.

UNIT-V: Industrial Platforms And Trending Developments **(9 Hours)**
Case Studies on Cloud Platforms: Software as a Service (SaaS) - Salesforce.com; Platform as a Service (PaaS) - Google App Engine, MS-Azure and IBM Bluemix; Infrastructure as a Service (IaaS) - Amazon EC2, Amazon S3 and Netflix; Enhancements in cloud - Energy efficiency in clouds, Market based management of clouds, Federated clouds / InterCloud, Third party cloud services.

Total Hours: 45

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, *Mastering Cloud Computing: Foundations and Applications Programming*, Morgan Kaufmann, 1st Edition, 2013.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, *Cloud Computing: Concepts, Technology & Architecture*, PHI, 1st Edition, 2013.

REFERENCE BOOKS:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, McGraw Hill, 1st Edition, 2010.
2. George Reese, *Cloud Application Architectures: Building Applications and Infrastructure in the Cloud*, O'Reilly, 1st Edition, 2009.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M.Tech. (CNIS) II Semester

(16MT12501) CLOUD COMPUTING

(Common to SE, CS & CNIS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITES:

Courses on "Operating Systems" and "Computer Networks"

COURSE DESCRIPTION:

Virtualization, Case studies – XEN, VMware, Microsoft Hyper-V; Cloud architecture; Services and Applications; Cloud Programming; Industry practices and Case studies –Amazon Web Services, Google App Engine, and Microsoft Azure.

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

CO1: Demonstrate knowledge on Virtualization models, Cloud Architecture, Services and Programming concepts.

CO2: Analyze the problems in existing cloud architectures.

CO3: Apply concurrent programming, throughput computing and Data intensive computing in Cloud programming.

CO4: Conduct research on emerging technologies in cloud and energy management in cloud

CO5: Apply virtualization techniques to optimize resource sharing.

DETAILED SYLLABUS:

Unit I: INTRODUCTION TO VIRTUALIZATION (9 Periods)

Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples – XEN, VMware, Microsoft Hyper-V.

UNIT II: CLOUD ARCHITECTURE (11 Periods)

Introduction to Cloud: Defining Cloud Computing, Cloud Types - The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, Assessing the Role of Open Standards.

Cloud Architecture: Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, and Applications.

UNIT III: DEFINING CLOUD SERVICES (10 Periods)

Defining Infrastructure as a Service (IaaS) – IaaS workloads, Pods, aggregation, and silos, **Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS)** – SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS, **Defining Identity as a Service (IDaaS)** – Introduction to identity,

Networked identity service classes, Identity system codes of conduct, IDaaS interoperability, **Defining Compliance as a Service (CaaS)**.

UNIT IV: CLOUD PROGRAMMING CONCEPTS (12 Periods)

Concurrent Programming – Introduction to Parallelism for Single Machine Computation, Programming Applications with Threads, **High Throughput Computing** – Task Programming, Task based Application Models, **Data Intensive Computing** – Introduction to Data Intensive Computing and Technologies for Data Intensive Computing.

UNIT V: INDUSTRIAL PLATFORMS AND TRENDING DEVELOPMENTS (13 Periods)

Case Studies on Cloud Platforms – Amazon Web Services, Google App Engine, and Microsoft Azure, Case Studies on Cloud Applications – Scientific Applications, Business and Consumer Applications.

Enhancements in Cloud – Energy Efficiency in Clouds, Market based Management of Clouds, Federated Clouds / InterCloud, Third Party Cloud Services.

Total Periods: 55

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi, "*Mastering Cloud Computing: Foundations and Applications Programming,*" 1ed, McGraw Hill, New Delhi, 2013.
2. Barrie Sosinsky, "*Cloud Computing Bible,*" 1ed, Wiley India Pvt Ltd, New Delhi,2011.

REFERENCE BOOKS:

1. Toby J. Velte , Anthony T. Velte, and Robert Elsenpeter, "*Cloud Computing: A Practical Approach,*" 1ed, Tata McGraw Hill, 2010.
2. George Reese, "*Cloud Application Architectures,*" 1ed, O'Reilly Publishers, 2010.

M. Tech. (CNIS) – I Semester
(19MT16305) MALWARE AND RISK ANALYSIS
(Program Elective - 2)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION:
Study of methods for identifying malwares in a system or network, Advanced static and dynamic malware analysis, Risk management and identification, Methods to maintain information by applying risk management policies, Threat vulnerability and assessment, Risk evaluation.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Analyze and apply the techniques of static and dynamic methods to identify and classify malwares.
CO2. Evaluate the threats and vulnerability of risk using risk evaluation procedures in order to protect information.

DETAILED SYLLABUS:

UNIT-I: Basic Analysis **(9 Hours)**
Basic Static Techniques: Antivirus scanning, A fingerprint for malware, Finding strings, Packed and obfuscated malware, Portable executable file Format, Linked libraries and functions.
Malware Analysis in Virtual Machines: The structure of a virtual machine, Creating and using malware analysis machine, The risks of using VMware for malware analysis, Record/Replay - Running computer in reverse.
Basic Dynamic Analysis: Sandboxes, The Quick-and-Dirty Approach, Running malware, Monitoring with process monitor, Viewing processes with process explorer, Comparing registry snapshots with Regshot, Faking a network, Packet sniffing with Wireshark, Using INetSim.

UNIT-II: Advanced Static Analysis **(9 Hours)**
X86 Disassembly: Levels of abstraction, Reverse engineering, x86 architecture.
Interactive Disassembler Professional (IDA): IDA Pro interface, Using cross references, Analyzing functions, Using graphing options, Enhancing disassembly.
Recognizing Code Constructs in Assembly: Global vs. Local variables, Disassembling arithmetic operations, Recognizing if statements, Recognizing loops, Understanding function call conventions, Analyzing switch statements, Disassembling arrays, Identifying structs, Analyzing linked list traversal.

UNIT-III: Advanced Dynamic Analysis **(9 Hours)**
Debugging: Source level vs. assembly level debuggers, Kernel mode vs. user mode debugging, Using a debugger, Exceptions, Modifying execution with a debugger, Modifying program execution.
OllyDbg: The OllyDbg interface, Memory map, Viewing threads and stacks, Tracing, Patching, Analyzing shellcode.
Anti-Reverse Engineering: Anti-disassembly, Anti-debugging, Packers and unpacking.

UNIT-IV: Risk Management and Identification **(9 Hours)**
Information Risk Management Programme: Goals, Scope and objectives, Roles and responsibilities, Governance of the risk management programme, Information risk management criteria.
Risk Identification: The approach to risk identification, Impact assessment, Types of impact, Qualitative and quantitative assessments

UNIT-V: Risk Assessment, Analysis and Evaluation **(9 Hours)**
Threat and Vulnerability Assessment: Conducting threat assessments, Conducting vulnerability assessments, Identification of existing controls
Risk Analysis and Risk Evaluation: Assessment of likelihood, Risk analysis, Risk evaluation.

Total Hours: 45

TEXT BOOKS:

1. Michael Sikorski and Andrew Honig, *Practical Malware Analysis*, No Starch Inc. 2012.
2. Sutton, David, *Information Risk Management: A Practitioner's Guide*, BCS Learning & Development Limited, 2014.

REFERENCE BOOKS:

1. Michael Ligh, Steven Stair, *Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code*, Wiley Publishing Inc., 2011.
2. Monnappa K. A., *Learning Malware Analysis*, Packt Publisher, 2018.

M. Tech. (CNIS) – I Semester
(19MT10531) ADVANCED ALGORITHMS LAB
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES: A Course on Computer Programming.

COURSE DESCRIPTION:
Hands on practice on algorithmic design techniques - Divide and conquer, Greedy methods Dynamic programming, Backtracking, Sum of subset problem, Vertex cover problem, Flow networks, String matching algorithms and Randomized algorithms.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Implement various algorithmic techniques greedy method, dynamic programming, backtracking, advanced graph theory and analyze the comparison of different techniques.
CO2. Design algorithms to solve real world computing problems and evaluate their efficiency.
CO3. Write, present technical report/document effectively.
CO4. Function effectively as an individual and as a member in team to implement mini-project.

LIST OF EXERCISES:

1. Write a program to implement Job sequencing with deadlines using greedy method.
2. Implement the 0/1 Knapsack problem using
   a) Dynamic Programming method b) Greedy method
3. Implement N-queen's problem using Backtracking. The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other. The expected output is a binary matrix which has 1s for the blocks where queens are placed. For example following is the output matrix for above 4 queen problem's solution.
   {0, 1, 0, 0},{0, 0, 0, 1},{1, 0, 0, 0},{0, 0, 1, 0}
4. Find a subset of a given set S = {s1, s2,.....,Sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1, 8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
5. Write a program to implement
   a) Vertex cover problem b) Maximum bipartite matching problem in the graph
6. Write a program to implement Ford-Fulkerson method for maximum flow networks.
7. Write a program to implement Chinese remainder theorem.
8. Write a program to solve string matching problem using Naïve approach and Knuth-Morris-Pratt algorithm.
9. Write a program to solve string matching problem and determine its performance.
   a) Finite Automata b) Rabin Karp algorithm
10. Write a program to implement a Monte Carlo algorithm to test the primarily of a given integer and determine its performance.
11. Mini Project

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, PHI Learning, 3rd Edition, 2009.
2. Ellis Horowitz, Sartaj Sahni, and S Rajasekaran, *Fundamentals of Computer Algorithms*, Universities Press, 2nd Edition, 2008.

M. Tech. (CNIS) – I Semester
(19MT10532) ADVANCED DATA STRUCTURES LAB
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES: A Course on Computer Programming.

COURSE DESCRIPTION:
Hands on practice on Linked Lists, Stacks and Queues, Binary search tree, AVL tree, Red black tree, Splay tree, KD tree, Priority search tree and Hashing.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Implement linear and non linear data structures like stacks, queues, linked lists, trees, graphs and hash functions to simulate by organizing the data in memory.
CO2. Design and develop appropriate algorithms to store and retrieve the data.
CO3. Write, present technical report/document effectively.
CO4. Function effectively as an individual and as a member in team to implement mini-project.

LIST OF EXERCISES:

1. Write program to implement the following Data structures:
    a) Single linked list
    b) Double linked list
    c) Circular linked list
2. Write a program to implement Stack and Queue
    a) Dequeue
    b) Circular queue
    c) Stack using two queues
    d) Queue using two stacks
3. Write a program to perform the following operations on binary search tree:
    a) Insertion b) Deletion c) Searching
4. Write a program to perform the following operations on AVL-tree:
    a) Insertion b) Deletion
5. Write a program to perform operations on Red Black tree.
6. Write a program to perform the following operations on splay-tree:
    a) Insertion b) Deletion
7. Write a program to implement Graph traversal techniques.
8. Implement the following functions of a dictionary using open addressing hashing techniques.
    a) Insertion b) Searching c) Deletion
9. Write a program to implement searching in Priority Search Tree.
10. Implement the following functions of K-D tree operations.
    a) Insert b) Update c) Delete
11. Mini Project

REFERENCE BOOKS:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, Pearson, 4th Edition, 2014.
2. Michael T. Goodrich, Roberto Tomassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, Wiley, 2002.

M. Tech. (CNIS) – I Semester
(19MT1AC01) TECHNICAL REPORT WRITING
(Audit Course)
(Common to all M. Tech. Programs)

Internal Marks	External Marks	Total Marks	L	T	P	C
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PRE-REQUISITES: NIL

COURSE DESCRIPTION:
Introduction, Process of writing, Style of writing, Referencing, Presentation.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Demonstrate knowledge of Technical Report Writing by examining kinds of reports and structure with scientific attitude.
CO2. Apply the techniques in preparing effective reports by examining Techniques of Description, Describing Machines and Mechanisms and Describing Processes.
CO3. Communicate effectively through writing technical reports by demonstrating the knowledge of Industry Reports, Survey Reports, Interpretive Report and Letter Report.

DETAILED SYLLABUS:

UNIT-I: Introduction **(6 Hours)**
Introduction to Technical Report - Types of Reports - Planning Technical Report Writing - Components of a Technical Report - Report Writing in Science and Technology - Selecting and Preparing a 'Title' - Language Use in Report Writing

UNIT-II: Process of Writing **(6 Hours)**
Writing the 'Introduction' - Writing the 'Materials and Methods' - Writing the Findings/Results' - Writing the 'Discussion' - Preparing and using 'Tables'

UNIT-III: Style of Writing **(6 Hours)**
Preparing and using Effective 'Graphs' - Citing and Arranging References—I - Citing and Arranging References —II - Writing for Publication in a Scientific Journal

UNIT-IV: Referencing **(8 Hours)**
Literature citations - Introductory remarks on literature citations - Reasons for literature citations - Bibliographical data according to ISO - Citations in the text - Copyright and copyright laws - The text of the Technical Report - Using word processing and desktop publishing (DTP) systems - Document or page layout and hints on editing - Typographic details - Cross-references

UNIT-V: Presentation **(4 Hours)**
Giving the presentation - Appropriate pointing - Dealing with intermediate questions - Review and analysis of the presentation - Rhetoric tips from A to Z

Total Hours: **30**

TEXT BOOKS:

1. R C Sharma, Krishna Mohan, *Business Correspondence and Report Writing,* Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd edition, 2005 (reprint).
2. Patrick Forsyth*, How to Write Reports and Proposals,* The Sunday Times (Kogan Page), New Delhi, Revised 2nd edition, 2010.

REFERENCE BOOKS:

1. John Seely, *The Oxford Writing & Speaking*, Oxford University Press, Indian Edition.
2. Anne Eisenberg, *A Beginner's Guide to Technical Communication*, McGraw Hill Education (India) Private Limited, New Delhi, 2013.

M. Tech. (CNIS) – II Semester
(19MT26301) CRYPTOGRAPHY AND NETWORK SECURITY

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Course on Computer Networks.

COURSE DESCRIPTION:
Concepts of Security models, Cryptographic algorithms, Public key and private key encryption and decryption, Hash algorithms, Intrusion Detection and prevention, IP security, Web security, Analysis of security principles in Internet and system security.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Cognize the concepts of cryptography and network security to identify potential threats in computer networks.
CO2. Develop solutions to solve security related issues in computer network applications.
CO3. Apply the appropriate cryptographic techniques and security algorithms in the area of information security to maintain security services.

DETAILED SYLLABUS:

UNIT-I: Network Security Concepts **(9 Hours)**
Security attacks, Security services, Security mechanisms, Fundamental security design principles, A model for network security, Mono-alphabetic ciphers and poly-alphabetic ciphers.

UNIT II -Introduction to Number Theory and Symmetric Ciphers **(9 Hours)**
Number Theory - Divisibility and the division algorithm, Euclidean algorithm, Modular arithmetic, Prime numbers, Fermat's and Euler theorem, Testing for primality.
Classical Encryption Techniques - Symmetric cipher model, Substitution techniques, Transposition techniques, Data Encryption Standard (DES), Advanced Encryption Standard (AES).

UNIT-III: Asymmetric Ciphers and Cryptographic Data Integrity Algorithms **(9 Hours)**
Public Key Cryptography: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman key exchange, ElGamal cryptosystem.
Cryptographic Hash Functions and MAC: Simple hash functions, Requirements, Secure hash functions – SHA-1, SHA-512; Message authentication requirements, HMAC and MD5.

UNIT-IV: Mutual Trust **(9 Hours)**
Key Distribution and User Authentication: Symmetric Key Distribution Using symmetric and asymmetric encryption, X.509 certificates, Kerberos, Personal identity verification.
Electronic Mail Security: S/MIME, Pretty Good Privacy (PGP), DNSSEC, Domain keys identified mail.
Web Security- Web security landscape, Controlling access to your web content, Code signing and Microsoft's Authenticode.

UNIT-V: System Security and Intrusion Detection **(9 Hours)**
Malicious Software - Types, Viruses, Virus counter measures, DDOS attacks; Intruders - Intrusion detection, Password management; Firewalls - Firewall characteristics, Firewall basing, Types of firewalls, Firewall location and configurations.

Total Hours: 45

TEXT BOOKS:
1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson Education, 7th Edition, 2017.
2. Douglas R. Stinson, *Cryptography: Theory and Practice*, CRC Press, 3rd Edition, 2005.

REFERENCE BOOKS:
1. Simson Garfinkel, *Web Security: Privacy & Commerce*, 2nd Edition, O'Reilly Media, 2002.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M. Tech (CN&IS) I-Semester

(16MT20505) INFORMATION SECURITY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	*60*	*100*	*4*	*--*	*--*	*4*

PRE-REQUISITES:

A Course on "Computer Networks"

COURSE DESCRIPTION

Concepts of cryptographic algorithms, public key and private key encryption, security models, Hash Algorithms, Intrusion Detection, IP Security, analysis of security principles in internet and system security

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

*CO1.*Gain advanced knowledge in

- Symmetric and Asymmetric Encryption Algorithms
- Key distribution and message Authentication
- Hash algorithms and digital signature techniques
- IP security and Wireless network security
- Intrusion Detection and Firewall configurations

CO2. Analyze the symmetric algorithms, Public-Key Encryption and Hash Algorithms.

CO3. Develop solutions to solve the problems related to Public-Key Encryption, Digital signatures, Secure Hash Functions

*CO4.*Conduct research to identify efficient ciphers and cryptographic algorithms to provide novel solutions for real time applications

*CO5.*Apply the appropriate Cryptographic Techniques and security Algorithms in the area of Information Security

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (**10Periods**)

Security Attacks, Security Services, Security Mechanisms, Model for Network Security, Mono alphabetic cipher and Poly alphabetic cipher

Symmetric Block Encryption- Symmetric Block Encryption Algorithms-DES, Triple-DES, AES, Cipher Block Modes of Operation

UNIT-II: PUBLIC-KEY ENCRYPTION (10 Periods)

Message Authentication-Approaches to Message Authentication, Simple hash function, Secure Hash Functions –SHA-1, SHA-512, Message Authentication Codes and HMAC

Public-Key Cryptography-Public-Key Cryptography Algorithms-RSA, Diffie-Hellman Key Exchange, Digital signature standard

UNIT-III: NETWORK SECURITY APPLICATIONS (12 Periods)

Key Distribution and User Authentication-Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public Key Infrastructure

Electronic Mail Security-Pretty Good Privacy, Key Rings, Multipurpose Internet Mail Extensions, S/MIME - Functionality, Messages and certificate processing.

UNIT-IV: INTERNET SECURITY (11 Periods)

Transport Level Security- Secure Socket Layer and Transport Layer Security.

IP Security-Overview, Policy, Encapsulating Security Payload and IKE.

Wireless Network security- IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security

UNIT-V: SYSTEM SECURITY (10 Periods)

Intruders-Intrusion Detection, Password Management, Malicious Software - Types, Viruses, Virus Countermeasures, Worms.

Firewalls- Firewall Characteristics, Firewall Basing, Types of Firewalls, Firewall Location and Configurations.

Total number of Periods: 53

TEXTBOOKS:

1. William Stallings, "*Network Security Essentials: Applications and Standards,"* 4ed,Pearson Education, New Delhi,2011
2. Douglas R.Stinson, "*Cryptography – Theory and Practice,"* 3ed, CRC Press, 2005

REFERENCE BOOKS:

1. William Stallings, "*Cryptography and Network Security,"* 5ed, Pearson education, New Delhi, 2011.
2. Eric Maiwald, "*Fundamentals of Network Security"*, 1ed, McGraw-Hill, 2003

M. Tech. (CNIS) – II Semester
(19MT26302) WIRELESS SENSOR NETWORKS

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION:
Introduction to wireless sensor networks; Medium access control protocol design; Various routing protocols for wireless sensor networks; Security issues and requirements in wireless sensor Networks; Advanced concepts in wireless sensor networks.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Analyze and apply the concepts of wireless sensor networks to evaluate network architectures for improving the performance of the networks.
CO2. Evaluate varying routing protocols for wireless sensor networks to overcome the problems of transmission.

DETAILED SYLLABUS:

UNIT-I: Introduction of Wireless Sensor Networks **(9 Hours)**
Basic concepts of wireless sensor networks, Motivations, Applications, Performance metrics, History and design factors, Architecture of a sensor node, Different sensing scenarios using WSN, Challenges in implementing WSNs.

UNIT-II: Medium Access Control Protocol Design **(9 Hours)**
Characteristics of WSN, MAC related properties, MAC performance issues, MAC protocols for WSNs - Schedule based protocols, Random access based protocols; WSN protocols - synchronized, duty cycled; Contention based and contention free MAC protocols.

UNIT-III: Routing Protocols for Wireless Sensor Networks **(9 Hours)**
Issues with the adoption of ad-hoc routing protocols, Data-centric routing, Position based Geographic routing, Clustering based routing algorithm, QoS based routing protocols, Analysis of opportunistic routing.

UNIT-IV: Security in Wireless Sensor Networks **(9 Hours)**
Security requirements in WSNs, Different types of attacks in WSNs, Security protocols for WSNs, Time synchronization, Requirements and challenges, Basic ideas, Various protocols, Coverage problem in WSNs, OGDC coverage algorithm, Placement problem.

UNIT-V: Advanced Concepts in Wireless Sensor Networks **(9 Hours)**
Overview, Types and challenges, Design of wireless sensor networks for emerging scenarios, Design analysis of transition from WSN to IoT, Real life deployment, Underwater sensor nodes vs Terrestrial sensor networks.

Total Hours: 45

TEXT BOOKS:

1. W. Dargie and C. Poellabauer, *Fundamentals of Wireless Sensor Networks: Theory and Practice*, Wiley, 2010.
2. K. Sohraby, D. Minoli and Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, and Applications*, Wiley, 2007.

REFERENCE BOOKS:

1. Fei Hu and Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, CRC Press, 2010.
2. Feng Zhao, Leonidas Guibas, *Wireless Sensor Networks: An Information Processing Approach*, Elsevier, 1st Edition, 2005.

M. Tech. (CNIS) – II Semester

(19MT20503) ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

(Program Elective – 3)

(Common to CS, CNIS and SE)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Machine Learning.

COURSE DESCRIPTION:

Representation of neural network, Learning rule, Training algorithm, Activation functions, Convolution neural network and its variants, Long term dependencies in sequence-to-sequence classification, Regularization for deep learning, hyper parameter selection, Applications of deep learning.

COURSE OUTCOMES:

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

CO1. Apply conceptual knowledge to analyze various approaches for learning with deep neural networks.

CO2. Select appropriate libraries for using deep learning algorithms to implement various types of learning tasks in diverse domains.

CO3. Select optimal model parameters for different deep learning techniques using optimization techniques.

DETAILED SYLLABUS:

UNIT-I: Neural Networks **(9 Hours)**

Neural network representation, Topologies, Training, Activation functions, Perceptron learning, Rule and convergence Theorem, Adaline, Delta Rule, Exclusive OR problem, Multilayer perceptron.

UNIT-II: Training Feed-Forward Neural Networks **(9 Hours)**

Multilayer Feed Forward Backpropagation Algorithm, Delta rule and Learning rates, Other activation functions, Deficiencies of Backpropagation, Advanced algorithms, The effect of number of learning samples and number of hidden units, Stochastic and Minibatch gradient descent, Test sets, Validation sets, Overfitting - Preventing Overfitting.

UNIT-III: Convolutional Neural Networks **(9 Hours)**

The convolution operation, Parameter Sharing, Pooling, Variants of the basic convolution function, Data types, Efficient convolution algorithms, Random or Unsupervised features, Convolutional networks and the history of deep learning.

UNIT-IV: Recurrent Neural Networks **(9 Hours)**

Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence architectures, Deep recurrent networks, Recursive neural networks, The challenge of long-term dependencies, Echo state networks, Leaky units and other strategies for multiple time scales, The long short-term memory and other gated RNNs, Optimization for long-term dependencies, Explicit memory.

UNIT-V: Regularization for Deep Learning **(9 Hours)**

Parameter norm penalties, Dataset augmentation, Early stopping, Parameter tying and sharing, Dropout, Sparse representations, Bagging and other ensemble methods, Adversarial training, Performance metrics, Default baseline models, Selecting hyper parameters, Debugging strategies, Applications - Computer Vision, Speech Recognition, Natural Language Processing.

Total Hours: 45

TEXT BOOKS:

1. Ian Goodfellow I, Yoshua Bengio, Aaron Courville , *Deep Learning*, MIT Press, 2016.
2. Ben Krose, Patrick van der Smagt, *An Introduction to Neural Networks*, MIT Press, 8th Edition, 1996.

REFERENCE BOOK:

1. Yegnanarayana B., *Artificial Neural Networks*, PHI, 2012.

M. Tech. (CNIS) – II Semester
(19MT26304) GPU COMPUTING
(Program Elective – 3)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Architecture.

COURSE DESCRIPTION:
Parallelism and supercomputing, Multi-CPU and Multi-GPU solutions, Memory handling – Caches, Constant memory; Optimizing an application – Memory considerations, Transfers, Designing GPU-based systems, Parallel programming issues and challenges.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Acquire the concepts and principles of parallelism with GPUs, memory handling in a Multi-CPU/Multi-GPU environment and analyze the methods for optimizing computing applications.
CO2. Analyze problems to identify the bottlenecks in parallel programming and to design robust and efficient systems equipped with modern GPUs.
CO3. Apply memory techniques to solve memory issues in Multi-GPU environment for optimizing computing applications.

DETAILED SYLLABUS:

UNIT-I: Parallelism and Supercomputing **(7 Hours)**
Traditional serial code, Serial/Parallel problems, Concurrency, Types of parallelism, Flynn's taxonomy, Parallel patterns, History of Supercomputing – Multi-node computing, The early days of GPU coding, Single-core solution, NVIDIA and CUDA, GPU hardware.

UNIT-II: Multi-CPU and Multi-GPU Solutions **(8 Hours)**
Threads, Blocks, Grids, Warps, Block scheduling, Multi-CPU and Multi-GPU Solutions - Introduction, Locality, Multi-CPU systems, Multi-GPU systems, Algorithms on multiple GPUs, Selecting GPUs, Single-node systems, Streams, Multiple-node systems.

UNIT-III: Memory Handling **(11 Hours)**
Caches - Types of data storage, Register Usage; Shared Memory - Sorting using shared memory, Radix sort, A hybrid approach, Shared memory on different GPUs; Constant Memory - Constant memory caching, Constant memory broadcast, Constant memory updates at runtime; Global Memory - Score boarding, Global memory sorting, Sample sort, Texture Memory.

UNIT-IV: Optimizing an Application **(10 Hours)**
Parallel/Serial GPU/CPU problem breakdown, Analyzing the problem, Time, Problem decomposition, Dependencies, Dataset size, Resolution, Identifying the bottlenecks, Grouping the tasks for CPU and GPU.
Memory Considerations: Memory bandwidth, Source of limit, Memory organization, Memory accesses to computation ratio, Loop and kernel fusion, Use of shared memory and cache.
Transfers: Pinned memory, Zero-copy memory, Bandwidth limitations, GPU timing, Overlapping GPU transfers.

UNIT-V: Designing GPU-Based Systems **(9 Hours)**
CPU processor, GPU device, PCI-E bus, GeForce cards, CPU memory, Air cooling, Liquid cooling, Desktop cases and motherboards, Mass storage, Power considerations, Operating systems.
Problems, Causes, and Solutions: Introduction, Parallel programming issues; Algorithmic issues; Finding and avoiding errors; Developing for future GPUs.

Total Hours: 45

TEXT BOOK:
1. Shane Cook, *CUDA Programming: A Developer's Guide to Parallel Computing with GPUs,* Morgan Kaufman, 1st Edition, 2013.

REFERENCE BOOK:
1. Gerassimos Barlas, *Multicore and GPU Programming: An Integrated Approach,* Morgan Kaufman, 1st Edition, 2015.

M. Tech. (CNIS) – II Semester
(19MT26305) INTERNET OF THINGS
(Program Elective - 3)
(Common to CNIS, CS, SE, DECS and CMS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Computer Networks, Python Programming.

COURSE DESCRIPTION:
Concepts of Domain Specific IoTs, M2M and system management with Netconf-Yang, IoT privacy and security, IoT physical devices, Amazon Web Services for IoT and case studies illustrating IoT design.

COURSE OUTCOMES:
CO1. Understand the concepts of IoT, IoT protocols, privacy and security issues in IoT applications to analyze domain specific IoT's.
CO2. Design solutions through implementing IoT applications on raspberry pi, AWS and develop security solutions to strengthen IoT environment.

DETAILED SYLLABUS:

UNIT-I: Concepts of IoT **(7 Hours)**
Definition and characteristics of IoT, Physical design of IoT – IoT protocols, Logical design of IoT, IoT enabling technologies, IoT levels and deployment templates.

UNIT-II: Domain Specific IoTs, IoT and M2M **(9 Hours)**
Domain Specific IoTs: Home automation, Cities, Environment, Energy, Logistics, Agriculture, Industry.
IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT.

UNIT-III: IoT System Management with NETCONF-YANG and Developing IoTs **(9 Hours)**
Need for IoT systems management, Simple Network Management Protocol (SNMP), Network operator requirements, NETCONF-YANG, IoT systems management with NETCONF-YANG.
Developing Internet of Things: Introduction, IoT design methodology.

UNIT-IV: IoT Privacy, Security And Vulnerabilities Solutions and IoT Physical Devices **(11 Hours)**
Introduction, Vulnerabilities, Security requirements and treat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity management and establishment, Access control and secure message communication, Security models, Profiles and protocols for IoT.
IoT Physical Devices and Endpoints: What is an IoT device, Exemplary device, About the board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python and other IoT devices.

UNIT-V: Amazon Web Services for IoT and Case Studies Illustrating IoT Design **(9 Hours)**
Amazon Web Services for IoT: Amazon EC2, Amazon AutoScaling, Amazon S3, Amazon RDS, Amazon DynamoDB.
Case Studies Illustrating IoT Design: Home automation, Cities, Environment and Agriculture.

Total hours: 45

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-on Approach*, Universities Press, 2015.
2. Raj Kamal, *Internet of Things: Architecture and Design Principles"*, McGraw Hill, 1st Edition, 2017.

REFERENCE BOOKS:

1. Adrian McEwen, Hakim Cassimally, *Designing the Internet of Things*, Wiley, 2013.
2. Jeeva Jose, *Internet of Things*, Khanna Publishing, 1st Edition, 2018.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M. Tech (CN&IS) I-Semester

(16MT10507) INTERNET OF THINGS

(Professional Elective-1)

(Common to CS and CNIS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	*60*	*100*	*4*	*-*	*--*	*4*

PRE-REQUISITES:

C*ourses on "Computer Networks" and "Java"*

COURSE DESCRIPTION:

Domain Specific IoT's; M2M& System Management with Netconf-Yang; Developing Internet of Things Using Python; IoT Physical Devices & Case Studies Illustrating IoT Design

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Gain knowledge on

- Building blocks of Internet of Things and characteristics.
- Application areas of IoT
- Concept of M2M (machine to machine) with necessary protocols

CO2: Analyze Domain specific IoT's, revolution of Internet in Mobile Devices.

CO3: Design and Develop Techniques for solutions to solve the problems in IoT using Python Scripting Language.

CO4: Conduct research on domain specific IoT's and IoT enabling Technologies.

CO5: Acquire knowledge to recognize the opportunities and contribute to collaborative-multidisciplinary Scientific Research.

DETAILED SYLLABUS:

UNIT I: INTRODUCTION & CONCEPTS (08 periods)

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, Logical Design of IOT, IOT Enabling Technologies, IoT Levels and Templates

UNITII: DOMAIN SPECIFIC IOTS (09 periods)

Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style

UNITIII: M2M & SYSTEM MANAGEMENT WITH NETCONF-YANG (11 p*eriods*)

IoT and M2M – M2M, Difference between IOT and M2M, difference between SDN and NFV for IoT, Software defined networks, network function virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements.

Basics of IoT System Management with NETCOZF, YANG, YANG-NETCONF

UNITIV: DEVELOPING INTERNET OF THINGSUSING PYTHON

(15 periods)

Introduction, IOT Design Methodology, Installing Python, Language features of Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, File Handling, Date/ Time Operations, Classes, Exception handling, Python Packages of Interest for IoT.

UNIT V: IOT PHYSICAL DEVICES & ENDPOINTS (12 p*eriods*)

What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, Programming and IOT Devices, Case Studies Illustrating IoT Design: Home Automation, Cities and Agriculture.

Total Periods: *55*

TEXT BOOK:

1. Vijay Madisetti, Arshdeep Bahga," *Internet of Things A Hands-On Approach*", University Press, 2015.

REFERENCE BOOKS:

1. Adrian McEwen, "*Designing the Internet of Things*", Wiely Piblishers, 2014.
2. Daniel Kellmereit, "*The Silent Intelligence: The Internet of Things*", 2013, DND Ventures LLc, 2013.

M. Tech. (CNIS) – II Semester
(19MT20508) SOFT COMPUTING
(Program Elective - 4)
(Common to CS and CNIS)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Mathematical Foundations of Computer Science, Machine Learning.

COURSE DESCRIPTION:
Introduction to neural networks, Applications and scope of neural networks, Basic models of artificial neural networks, Supervised and unsupervised learning networks, Associative memory networks, Fuzzy logic and fuzzy sets, Genetic algorithms, Hybrid soft computing techniques and its applications.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Review the feasibility of applying a soft computing methodology for a particular problem.
CO2. Analyze architectures of neural networks, genetic algorithms, hop field networks, and hybrid soft computing techniques to solve combinatorial optimization problems using genetic algorithms.
CO3. Develop hybrid algorithms using soft computing techniques by integrating ANN and genetic algorithms.

DETAILED SYLLABUS:

UNIT-I: Introduction **(9 Hours)**
Neural networks, Application and scope of neural network, Fuzzy logic, Genetic algorithm, Hybrid systems, Basic models of artificial neural network, Linear separability.

UNIT-II: Supervised and Unsupervised Learning Networks **(9 Hours)**
Supervised Learning Networks: Perceptron networks, Adaptive linear neuron, Multiple adaptive linear neuron, Radial basis function network, Backpropagation network.
Unsupervised Learning Networks: Kohonen self-organizing feature maps, Learning vector quantization.

UNIT-III: Associative Memory Networks **(9 Hours)**
Training algorithms for pattern association, Autoassociative memory network, Heteroassociative memory network, Bidirectional associative memory, Hop field networks.

UNIT-IV: Fuzzy Logic and Genetic Algorithms **(9 Hours)**
Fuzzy Logic: Classical sets, Fuzzy sets, Fuzzy relations, Cartesian product of relation, Tolerance and equivalence relation, Fuzzy decision making.
Genetic Algorithms: Biological background, Traditional optimization and search techniques, Genetic algorithm and search space, Terminologies, General genetic algorithm, Operators, Stopping condition, Constraints, Schema theorem.

UNIT-V: Hybrid Soft Computing Techniques **(9 Hours)**
Genetic neuro-hybrid system, Properties, Genetic algorithm based back-propagation network (BPN).
Applications: Flood area analysis, Optimization of travelling salesman problem, Internet search engines.

Total Hours: 45

TEXT BOOKS:
1. S.N. Sivanandam and S.N. Deepa, *Principles of Soft Computing,* Wiley, 2nd Edition, 2011.

REFERENCE BOOKS:
1. J. –S. R. Jang, C. –T. Sun, E. Mizutani, *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence*, Pearson, 2015.
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications*, PHI, 2011.

M. Tech. (CNIS) – II Semester
(19MT26306) BLOCKCHAIN TECHNOLOGIES
(Program Elective – 4)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses Data Structures & Algorithms, Network Security and Cryptography.

COURSE DESCRIPTION: Introduction to Blockchain Technologies and its decentralization concepts, Smart Contracts, Ethereum, Hyperledger, Alternative Blockchains, Emerging Trends, Challenges and Scope of Research.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Cognize the concepts of distributed systems, decentralization and Blockchains and analyze the ecosystem of Blockchains.
CO2. Evaluate different distributed Blockchain platforms and devise suitable platforms for scalable and secured applications.

DETAILED SYLLABUS:

UNIT-I: Introduction to Blockchain Decentralization **(11 Hours)**
Distributed Systems: CAP theorem, Byzantine general's problem, Consensus, History of Blockchain, Introduction to Blockchain - Definitions, Generic elements, Features, Applications, Tiers, Types of Blockchain, CAP theorem & Blockchain, Benefits and limitations of Blockchain technology.
Decentralization: Decentralization using Blockchain, Methods of decentralization, Routes to decentralization, Blockchain & full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for decentralization.

UNIT-II: Smart Contracts **(7 Hours)**
History & Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deployment of smart contracts on Blockchains.

UNIT-III: Ethereum **(9 Hours)**
Introduction, Ethereum Blockchain, Elements of Ethereum Blockchain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining, Clients & wallets, Ethereum network, Applications developed on Ethereum, Scalability & security issues.

UNIT-IV: Hyperledgers and Alternative Blockchains **(9 Hours)**
Hyperledgers: Projects, Hyperledger as protocol, Fabric, Hyperledger Fabric, Sawtooth Lake, Corda.
Alternative Blockchains: Blockchains - Kadena, Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigChainDB, Multichain, Tendermint; Platforms - BlockApps, Eris.

UNIT-V: Challenges, Emerging Trends and Research **(9 Hours)**
Current Challenges: Scalability - Block size increase, Block internal reduction, Invertible Blooms lookup tables, Sharding, State channels, Private Blockchain, Proof of stake; Privacy - Indistinguishability obfuscation, Homomorphic encryption, Zero knowledge proofs, State channels, Secure multiparty computation, Usage of hardware to provide confidentiality, Coinjoin, Confidential transactions, MimbleWimble; Security - Smart contract security.
Emerging Trends: Emerging Trends, Improvement proposals, Blockchain research - Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability, Code obfuscation.

Total Hours: 45

TEXT BOOK:
1. Imran Bashir, *Mastering Blockchain*, Packt Publishing Ltd., 1st Edition, 2017.

REFERENCE BOOKS:
1. Arshdeep Bahga, Vijay Madisetti, *Blockchain Applications: A Hands-On Approach*, VPT Books, 2017.
2. Josh Thompson, *Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming*, Create Space Independent Publishing Platform, 2017.

M. Tech. (CNIS) – II Semester

(19MT26307) SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

(Program Elective – 4)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Cryptography and Network Security, Software Engineering.

COURSE DESCRIPTION:

Importance of design secure software's for enterprises, Approaches to design, develop, test and deploy the secure software systems to satisfy the goals of enterprise computing, Operating and maintaining secure software.

COURSE OUTCOMES:

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

CO1. Create a security process by identifying the roles of security team for an enterprise.

CO2. Analyze and design the enterprise software to enhance the security features based on code reuse, coding resources, reviews and security tiers.

CO3. Design and develop operation and maintenance procedures of secure software according to enterprise security policies.

DETAILED SYLLABUS:

UNIT-I: Introduction **(8 Hours)**

Introduction, Enterprise security, Project Inception - Without a formal security process, Case for project security team, Tasks for the project security team, Roles to cover on the security team.

UNIT-II: Design Activities **(9 Hours)**

Security tiers, On confluence, Requirements, Specifications, Design and architecture, Deployment and operation planning.

UNIT-III: Implementation Activities **(9 Hours)**

Confluence, Security mechanism and controls, Code reuse, Coding resources, Implementing security tiers, Code reviews, Servlet.

UNIT-IV: Testing and Deployment Activities **(9 Hours)**

Testing: Security testing, Tools of the trade, Security bug life cycle.

Deployment and Integration: Advances in deployment, Integrating with security operations infrastructure, Log analysis tools, Third party components.

UNIT-V: Operating and Maintaining Software **(10 Hours)**

Operating Software Securely: Adjusting security thresholds, IDS in operations, Identifying critical applications, CSIRT utilization.

Maintaining Software Securely: Common pitfalls, Maintaining software securely relate to confluence, Evolving threats, Security patch, Maintaining software securely fit into security SDLCs.

Total Hours: 45

TEXT BOOK:

1. Kenneth R. van Wyk, Mark G. Graff, *Enterprise Software Security: A Confluence of Disciplines*, Addison-Wesley Professional, 1st Edition, 2014.

REFERENCE BOOKS:

1. Gary McGraw, *Software Security: Building Security In*, Addison Wesley, 2006.
2. Mark Dowd, John McDonald and Justin Schuh, *The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities*, Addison Wesley, 1st Edition, 2006.
3. John Viega and Gary McGraw, Bu*ilding Secure Software: How to Avoid Security Problems the Right Way,* Addison-Wesley, 2001.

M. Tech. (CNIS) – II Semester
(19MT26308) SOFTWARE DEFINED NETWORKS
(Program Elective – 4)

Internal Marks	External Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Computer Networks.

COURSE DESCRIPTION:
Evolution of switches and control planes, SDN operations, Devices and controllers, Open flow basics, Network functions virtualizations, P2P overlay networks, SDN applications.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Design sustainable software defined network by comparing different architecture and open flow specifications.
CO2. Apply network function virtualization using hypervisor and cloud computing technology for network automation and orchestration.
CO3. Create proactive and reactive software defined network applications using tools like floodlight controller, daylight controller, Cisco XNC controller and Hewlett-Packard controller.

DETAILED SYLLABUS:

UNIT-I: Software Defined Networking **(9 Hours)**
Introduction, Evolution of switches and control planes, Cost, Data center innovation, Data center needs, The genesis of SDN, The evolution of networking technology, Sustaining SDN interoperability, Open source contributions, Legacy mechanisms evolve toward SDN, and network virtualization.

UNIT-II: Working of SDN **(9 Hours)**
Fundamental Characteristics of SDN, SDN operation, SDN devices, SDN controller, SDN applications, Alternate SDN methods, The open flow specification, Open flow overview, Open flow 1.0 and open flow basics, Open flow 1.1 additions, Open flow 1.2 additions, Open flow 1.3 additions, Open flow limitations.

UNIT-III: Alternative Definitions of SDN **(9 Hours)**
Potential drawbacks of open SDN, SDN via APIs, SDN via Hypervisor-based overlays, SDN via opening up the device, Network functions virtualization, Alternatives overlap and ranking.

UNIT-IV: SDN in the Data Center **(9 Hours)**
Data center definition, Data center demands, Tunneling technologies for the data center, Path technologies in the data center, Ethernet fabrics in the data center, SDN use cases in the data center, Open SDN versus overlays in the data center, Real-world data center implementations.

UNIT-V: SDN APPLICATINS **(9 Hours)**
Reactive versus proactive applications, Analyzing simple SDN applications, A simple reactive Java application, Background on controllers, Using the floodlight controller, Using the open daylight controller, Using the Cisco XNC controller, Using the Hewlett-Packard controller, Switch considerations, Creating network virtualization tunnels, Offloading flows in the data center, Access control for the campus, Traffic engineering for service providers.

Total Hours: 45

TEXT BOOKS:

1. Paul Goransson, Chuck Black, *Software Defined Networks: A Comprehensive Approach*, Elsevier, 2014.
2. Thomas D. Nadeau, Ken Gray, *SDN: Software Defined Networks*, O'Reilly Media, 2013.

REFERENCE BOOKS:

1. Siamak Azodolmolky, *Software Defined Networking with Open Flow*, Packt Publishing, 2013.
2. Patricia A. Morreale and James M. Anderson, *Software Defined Networking: Design and Deployment*, CRC Press, 2014.

M. Tech. (CNIS) – II Semester
(19MT26331) CRYPTOGRAPHY AND NETWORK SECURITY LAB

Internal Marks	External Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES: A Course on Computer Programming.

COURSE DESCRIPTION:
Practical implementation on Mono-alphabetic Ciphers, Poly-alphabetic Ciphers, DES, RSA, Diffie-Hellman Key Exchange mechanism, SHA-1 algorithm, MD5 algorithm, Digital Signature Standards and Intrusion Detection Systems.

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

CO1. Implement mono-alphabetic, poly-alphabetic ciphers, symmetric and public key encryption algorithms, secure hash functions, digital signature standards and intrusion detection systems.
CO2. Analyze the symmetric key encryption and public key encryption algorithms and evaluate their efficiency for different applications.
CO3. Write, present technical report/document effectively.
CO4. Function effectively as an individual and as a member in team to implement mini-project.

LIST OF EXERCISES:

1. Implement the following Mono-alphabetic Ciphers.
   a. Shift Cipher b. Hill Cipher
2. Implement the following Poly-alphabetic Ciphers.
   a. Playfair b. Vigenere
3. Write a program to implement the Data Encryption Standard(DES).
4. Write a program to implement RSA algorithm.
5. Write a program to implement Diffie-Hellman Key Exchange mechanism.
6. Write a program to determine the message digest of a given message using the SHA-1 algorithm.
7. Write a program to implement MD5 algorithm.
8. Write a program to implement the Signature Scheme - Digital Signature Standard.
9. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
10. Demonstrate Intrusion Detection System (IDS) using any tool (snort or any other s/w).
11. Mini Project.

REFERENCE BOOKS:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson Education, 7th Edition, 2017.
2. Douglas R. Stinson, *Cryptography: Theory and Practice*, CRC Press, 3rd Edition, 2005.

SREE VIDYANIKETHAN ENGINEERING COLLEGE (Autonomous)

Department of Computer Science and Engineering

I M. Tech. (CN&IS) I-Semester

(16MT16331) COMPUTER NETWORKS & INFORMATION SECURITY LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	*50*	*100*	*--*	*--*	*4*	*2*

PRE-REQUISITES:

Courses on "Computer Networks" and "Information Security"

COURSE DESCRIPTION:

Hands experience on Data Link Layer Farming Methods; Routing Algorithms; Implementation of DES, RSA; AES Algorithms, Secure Hash Algorithms and Digital Signature Standards.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1. Gain knowledge to implement

- Framing mechanisms for data link layer
- Shortest path routing algorithms
- Symmetric encryption algorithms- DES,AES and Asymmetric algorithm-RSA
- Secure Hash algorithms and digital signatures

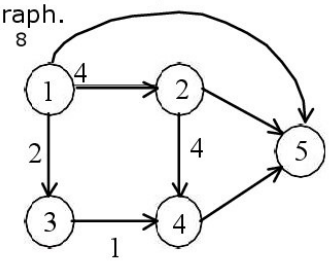
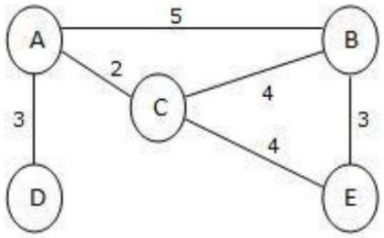
CO2. Analyze the routing algorithms, Symmetric-key encryption and public-key encryption algorithms.

CO3. Develop the solutions to solve the problems in networks and information security systems.

CO4. Implement routing and encryption techniques using C or JAVA to provide solutions to the real world problems.

Laboratory Exercises:

Exercise Number.	Name of Experiment	No. of slots
1	Implement the following data link layer farming methods. a. Character Count b. Character Stuffing c. Bit Stuffing	1
2	Design a program to compute checksum for the given frame 1101011011 using CRC-12, CRC-16, CRC-CCIP. Display the actual bit string transmitted. Suppose any bit from is inverted during transmission. Show that this error is detected at the receivers end.	1

3	Implement Dijkstra's algorithm to compute the Shortest path through a graph. 	1
4	Design a program to obtain routing table for each node using distance vector routing algorithm by considering the given subnet with weights indicating delay between nodes. 	1
5	Write a program to simulates flow based routing	1
6	Simulate the Random Early Detection congestion control algorithm	1
7	Write a program to encrypt and decrypt given text using DES symmetric key algorithm	1
8	Write a program to encrypt and decrypt given text in public key cryptographic system using RSA	1
9	Write a program to encrypt and decrypt given text using AES algorithm with 128-bit key	1
10	Write a program to generate a Hash code for the given text using SHA-512 algorithm	1
11	Create a digital signature for the given doc/pdf file using DSS algorithm	1
12	Configure Firewall filters to accept/reject URLs/web content	1

REFERENCE BOOKS:

1. William Stallings, "*Network Security Essentials: Applications and Standards*," 4ed, New Delhi, Pearson Education, 2011
2. Nader F. Mir, "*Computer and Communication Networks*," Pearson Education, 2007
3. Eric Maiwald, "*Fundamentals of Network Security*", 4ed, Tata McGraw Hill, 2003

M. Tech. (CNIS) – II Semester
(19MT26332) WIRELESS SENSOR NETWORKS LAB

Internal Marks	External Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES:

COURSE DESCRIPTION:
Hands on Practice on Schedule-based, Random-based, Content-based and Cluster-based MAC Protocols, Split horizon of Routing Information Protocol, Position-based Geographic Routing Protocol, AODV Protocol in ADHOC.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Design and compute protocols for network requirements.
CO2. Apply latest tools and technologies for designing applications in various networking protocols.
CO3. Write, present technical report/document effectively.
CO4. Function effectively as an individual and as a member in team to implement mini-project.

LIST OF EXERCISES:

1. Simulate and evaluate a schedule-based multi-channel MAC Protocol for wireless sensor networks.
2. Simulate and evaluate a random access based MCMAC Protocol for wireless sensor networks.
3. Simulate and evaluate energy model of CSMA and ALOHA in content based MAC protocols.
4. Simulate and evaluate virtual cluster based on common sleep schedules in a contention free MAC Protocols (FDMA, TDMA,CDMA).
5. Reproduce and assess the split horizon of RIP in data-centric routing protocols.
6. Simulate and appraise the position of vehicular ad-hoc in position-based geographic routing protocols.
7. Reproduce and evaluate clustering scheme and hierarchies of AODC, a clustering based routing algorithm.
8. Simulate and performance evaluation of AODV protocol with QoS.
9. Mini Project

REFERENCE BOOKS:

1. W. Dargie and C. Poellabauer, *Fundamentals of Wireless Sensor Networks: Theory and Practice*, Wiley, 2010.
2. K. Sohraby, D. Minoli and Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, and Applications*, Wiley, 2007.

M. Tech. (CNIS) – II Semester
(19MT2AC01) STATISTICS WITH R
(Audit Course)
(Common to All M. Tech. Programs)

Internal Marks	External Marks	Total Marks	L	T	P	C
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PRE-REQUISITES: A course on Statistics.

COURSE DESCRIPTION:
Concepts of R programming basics, Bivariate and multivariate data, Confidence intervals, Goodness of fit, Analysis of variance.

COURSE OUTCOMES:
On successful completion of the course, students will be able to:
CO1. Import, manage, manipulate, and structure data files using R programming.
CO2. Implement models for statistical analysis of a given dataset and visualize the results to identify trends, patterns and outliers in data.

DETAILED SYLLABUS:

UNIT-I: Introduction **(5 Hours)**
Data, R's command line, Variables, Functions, The workspace, External packages, Data sets, Data vectors, Functions, Numeric summaries, Categorical data.

Unit II - Bivariate and Multivariate Data **(7 Hours)**
Lists, Data frames, Paired data, Correlation, Trends, Transformations, Bivariate categorical data, Measures of association, Two-way tables, Marginal distributions, Conditional distributions, Graphical summaries, Multivariate data - Data frames, Applying a function over a collection, Using external data, Lattice graphics, Grouping, Statistical transformations.

UNIT-III: Populations **(6 Hours)**
Populations, Discrete random variables, Random values generation, Sampling, Families of distributions, Central limit theorem, Statistical Inference - Significance tests, Estimation, Confidence intervals, Bayesian analysis.

UNIT-IV: Confidence Intervals **(6 Hours)**
Confidence intervals for a population proportion, *p* - population mean, Other confidence intervals, Confidence intervals for differences, Confidence intervals for the median, Significance test - Significance test for a population proportion, Significance test for the mean (t-tests), Significance tests and confidence intervals, Significance tests for the median.

UNIT-V: Goodness of Fit **(6 Hours)**
The chi-squared goodness-of-fit test, The multinomial distribution, Pearson's χ^2-statistic, chi-squared test of independence and homogeneity, Goodness-of-fit tests for continuous distributions, ANOVA - One-way ANOVA, Using *lm* for ANOVA.

Total Hours: 30

TEXT BOOKS:
1. John Verzani, *Using R for Introductory Statistics*, CRC Press, 2nd Edition, 2014.
2. Sudha G Purohit, Sharad D Gore, Shailaja R Deshmukh, *Statistics Using R*, Narosa Publishing house, 2nd Edition, 2015.

REFERENCE BOOKS:
1. Francisco Juretig, *R Statistics Cookbook*, Packt Publishing, 1st Edition, 2019.
2. Prabhanjan N. Tattar, Suresh Ramaiah, B. G. Manjunath, *A Course in Statistics with R*, Wiley, 2018.