NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

M. Tech in Computer Science & Engineering (CSE)

(Effective from the Session: 2020-21)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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M. TECH (CSE)
Evaluation Scheme
SEMESTER I

Sl. No.	Subject Codes	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	AMTCSE0101	Advanced Data Structures and Algorithms	3	0	0	20	10	30		70		100	3
2	AMTCSE0102	Artificial Intelligence	3	0	0	20	10	30		70		100	3
3	AMTCC0101	Research Process and Methodology	3	0	0	20	10	30		70		100	3
4		Elective -I*	3	0	0	20	10	30		70		100	3
5		Elective -II*	3	0	0	20	10	30		70		100	3
6	AMTCSE0151	Advanced Data structures and Algorithms Lab	0	0	4				20		30	50	2
7	AMTCSE0152	Artificial Intelligence Lab	0	0	4				20		30	50	2
		TOTAL										**600**	**19**

(*) Refer the Electives list

MOOCs Link:

https://nptel.ac.in/courses/106/106/106106127/

https://nptel.ac.in/courses/112/103/112103280/

https://nptel.ac.in/courses/106/102/106102220/

https://nptel.ac.in/courses/106/106/106106126/

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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M. TECH (CSE)
Evaluation Scheme
SEMESTER II

Sl. No	Subject Codes	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	AMTCSE0201	High Performance Computing	3	0	0	20	10	30		70		100	3
2	AMTCSE0202	Robotic Process Automation	3	0	0	20	10	30		70		100	3
3		Elective – III*	3	0	0	20	10	30		70		100	3
4		Elective- IV*	3	0	0	20	10	30		70		100	3
5		Elective- V*	3	0	0	20	10	30		70		100	3
6	AMTCSE0251	High Performance Computing Lab	0	0	4				20		30	50	2
7	AMTCSE0252	Robotic Process Automation Lab	0	0	4				20		30	50	2
8	AMTCSE0253	Seminar-I	0	0	2				50			50	1
		TOTAL										**650**	**20**

(*) Refer the Electives list

MOOCs Link:

https://onlinecourses.nptel.ac.in/noc20_cs62/preview

https://onlinecourses.nptel.ac.in/noc20_cs73/preview

https://nptel.ac.in/courses/106/106/106106213/

https://nptel.ac.in/courses/106/105/106105216/

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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M. TECH (CSE)
Evaluation Scheme
SEMESTER III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Seminar-II	0	0	6				100			100	3
2		Pre-Dissertation	0	0	30				200		300	500	15
		TOTAL										**600**	**18**

M. TECH (CSE)
Evaluation Scheme
SEMESTER IV

Sl. No.	Subject Codes	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Dissertation (Final)	0	0	36				200		400	600	18
		TOTAL										**600**	**18**

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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LIST OF ELECTIVES:-

	Subject Code	Elective – I*
1	AMTAI0111	Soft Computing.
2	AMTAI0112	Introduction to IoT
3	AMTCSE0111	Cloud Computing
4	AMTCSE0112	Advanced Operating Systems
5	AMTCY0111	Advanced Security of Networked Systems
6	AMTCY0112	Fundamentals of Data Science and Applications
		Elective – II*
1	AMTAI0113	Pattern Recognition
2	AMTAI0114	Information Retrieval
3	AMTCSE0113	Distributed Computing
4	AMTCSE0114	Data Warehousing & Data Mining
5	AMTCY0113	Mobile Wireless Networks and Security
6	AMTCY0114	Object Oriented Software Engineering
		Elective – III*
1	AMTAI0211	Computer Vision
2	AMTAI0212	Neural Network
3	AMTCSE0211	Software Project & Management
4	AMTCSE0212	Virtual and Augmented Reality
5	AMTCY0211	Cyber Crimes, Cyber Laws and Cyber Forensics
6	AMTCY0212	Data Science for Security Analysis
		Elective – IV*
1	AMTAI0213	Reinforcement Learning
2	AMTAI0214	Introduction to Blockchain
3	AMTCSE0213	Digital Image Processing
4	AMTCSE0214	Distributed Database
5	AMTCY0213	Cyber Forensics Tools and Technology
6	AMTCY0214	Intrusion Detection System
		Elective – V*
1	AMTAI0215	Natural Language Processing
2	AMTAI0216	Deep Learning
3	AMTCSE0215	Modeling &Simulation
4	AMTCSE0216	Advanced Computer Architecture
5	AMTCY0215	Software Protection
6	AMTCY0216	Information Security

Note *: Student can choose elective subject from the specific branch only.

M.TECH FIRST YEAR

Course Code	AMTCSE0101		L T P	Credit
Course Title	**Advanced Data Structures and Algorithms**		3 0 0	3

Course objective:

1	To provide an overview of data structures and algorithms
2	To analyze the concept of data structures through ADT including List, Stack, Queues.
3	To be familiar with advanced data structures such as height balanced trees, hash tables, priority queues.
4	To understand concepts about searching, sorting and hashing techniques.
5	To analyze problems and writing program solutions to problems by identifying the appropriate data structure.

Course Contents / Syllabus

UNIT-I	Introduction DATA STRUCTURES	8

Models of computation, algorithm analysis, time and space complexity, average and worst case analysis.Introduction Abstract Data Types (ADT), Stack Queue,Circular Queue, Double Ended Queue, Applications of stack, Evaluating Arithmetic Expressions, Other Applications ,Applications of Queue,Linked Lists, Singly Linked List, Circularly Linked List , Doubly Linked lists , Applications of linked list – Polynomial Manipulation.

UNIT-II	LINEAR /NON-LINEAR TREE STRUCTURES	8

 Binary Tree expression trees, Binary tree traversals, applications of trees, Huffman Algorithm , Binary search tree, Balanced Trees, AVL Tree, B-Tree, Splay Trees ,Heap, Heap operations-,Binomial Heaps, Fibonacci Heaps, Hash set. Hashing: Implementation of Dictionaries, Hash Function, Collisions in Hashing, Separate,Chaining, Open Addressing, and Analysis of Search Operations. Introduction to Red – Black trees and Splay Trees, B-Trees-B-Tree of order m, height of a B-Tree, insertion, deletion and searching, Comparison of Search Trees.

UNIT-III	GRAPHS	8

Representation of graph,Graph Traversals, Depth-first and breadth-first traversal , Applications of graphs ,Topological sort, shortest-path algorithms, Dijkstra's algorithm, Bellman-Ford algorithm – Floyd's Algorithm, minimum spanning tree ,Prim's and Kruskal's algorithms.

UNIT-IV	ALGORITHM DESIGN AND ANALYSIS	8

Algorithm Analysis, Asymptotic Notation,Divide and Conquer, Merge Sort, Quick Sort,Binary Search, Greedy Algorithms, Knapsack Problem, Dynamic Programming, Optimal Binary Search Tree,Warshall's Algorithm for Finding Transitive Closure.

UNIT-V	ADVANCED ALGORITHM DESIGN AND ANALYSIS	8

Backtracking, N-Queen's Problem, Branch and Bound. Assignment Problem, P & NP problems, NP-complete problems, Approximation algorithms for NP-hard problems,Traveling salesman problem-Amortized Analysis.Case Studies:Design algorithms for ad-hoc problems, File indexing, File system model,Searching in a B-tree, Sorting on disk

Course outcome: **After completion of this course students will be able to**

CO 1	Interpret the need of data structure and algorithms and analyze Time space trade-off.	K2, K4
CO 2	Understand various algorithms and solve classical problems	K2, K3
CO 3	Understand the advantages and disadvantages of linked lists over arrays and implement operations on different types of linked list.	K2, K3

| CO 4 | Implement and evaluate the real world applications using stacks, queues and non-linear data structures. | K3,K4 |
| CO 5 | Implement data structures with respect to its performance to solve a real world problem. | K3 |

Text books

1. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India

2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.

3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.

Reference Books

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education, 2015

2. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007

3. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms/C++", Second Edition, University Press, 2007

4. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education 2015

5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press 2015

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F https://www.youtube.com/watch?v=4OxBvBXon5w&list=PLBF3763AF2E1C572F&index=22 https://www.youtube.com/watch?v=cR4rxllyiCs&list=PLBF3763AF2E1C572F&index=23
Unit 2	https://nptel.ac.in/courses/106/106/106106127/
Unit 3	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLBF3763AF2E1C572F&index=2
Unit 4	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=tORLeHHtazM&list=PLBF3763AF2E1C572F&index=6 https://www.youtube.com/watch?v=eWeqqVpgNPg&list=PLBF3763AF2E1C572F&index=7
Unit 5	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24 https://www.youtube.com/watch?v=hk5rQs7TQ7E&list=PLBF3763AF2E1C572F&index=25 https://www.youtube.com/watch?v=KW0UvOW0XIo&list=PLBF3763AF2E1C572F&index=5

M.TECH FIRST YEAR			
Course Code	AMTCSE0102	**L T P**	**Credit**
Course Title	**Artificial Intelligence**	**3 0 0**	**3**

Course objectives:

This course aims to cover an overview of Artificial Intelligence (AI) principles and approaches and to develop the basic understanding of applying these techniques in applications involving perception, knowledge representation, and learning.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 hours**

Introduction to Artificial Intelligence, Historical developments of Artificial Intelligence, Agents, Intelligent Agents, Structure of Intelligent Agents, Virtual Agents, Multi-agent systems, Natural Language Possessing (NLP), Text Analytics, Applications of Artificial Intelligence, Chatbot, Brief introduction to python or other API tool used for Implementation like OPEN CV AND OPEN VINO, Introduction to Open Data

UNIT-II	**Logic Representation**	**8 hours**

Introduction of Logic, Propositional Logic concepts, Semantic Tableaux and Resolution in Propositional logic, First Order Predicate Logic (FOPL), Semantic Tableaux and Resolution in FOPL, Logic Programming in Prolog. Production systems and rules for some AI problems: water jug problem, missionaries-cannibals problem, Queens problem, monkey banana problem, Travelling salesman problem, etc. Solving problems by searching: state space formulation, iterative deepening.

UNIT-III	**Search Techniques**	**8 hours**

Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, adversarial Search, Search for games, minimax, Alpha - Beta pruning, Heuristic Search techniques, Hill Climbing, Problem reduction , Constraint satisfaction ,Means Ends Analysis. Uninformed Search, DFS, BFS, Iterative deepening Heuristic Search, A* etc

UNIT-IV	**Knowledge Representation & Expert System**	**8 hours**

Knowledge representation, semantic nets, partitioned nets, parallel implementation of semantic nets. Frames, Common sense reasoning and thematic role frames, Architecture of knowledgebased system, rule based systems, forward and backward chaining, Frame based systems. Architecture of Expert System, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM).

UNIT-V	**Planning and Learning**	**8 hours**

Planning with state space search, conditional planning, continuous planning, Multi-Agent planning, Forms of learning, inductive learning, Reinforcement Learning, learning decision trees, Neural Net learning and Genetic learning. Probabilistic Methods, Bayesian Theory, Dempster Shafer Theory, Bayes Network,
Evolutionary Algorithms: swarm intelligence, ant colony optimization.

Course outcomes: **After completion of this course students will be able to**

CO 1	Understand the fundamental of the artificial intelligence (AI) and its foundations.	K2
CO 2	Apply principles and techniques of AI in problem solving.	K3
CO 3	Analyze the various tools for application of AI.	K4

CO 4	Apply the concepts of knowledge based system used in AI.	K3
CO 5	Understand the various Evolutionary Algorithm in AI.	K2

Text books

1. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Third Edition, 2010, Pearson.

2. Denis Rothman,Artificial Intelligence By Example: Acquire advanced AI, machine learning, and deep learning design skills, 2nd Edition Paperback, 2020, Packt.

Reference books

1.Marvin Minsky, The Emotion Machine: Commonsense Thinking, Artificial Intelligence, and the Future of the Human Mind,2007**,** Simon & Schuster; Illustrated edition

2. Philip C. Jackson Jr.,Introduction to Artificial Intelligence: Second, Enlarged Edition (Dover Books on Mathematics) Paperback, 1985, Dover Publications; Second Edition, Enlarged)

3. Paul R. Daugherty, H. James Wilson,Human + Machine: Reimagining Work in the Age of AI, 2018,Harvard Business Review Press

NPTEL/Youtube/Faculty Video Link:

https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/

https://nptel.ac.in/courses/106/106/106106126/

https://nptel.ac.in/courses/106/106/106106140/

M. TECH FIRST YEAR			

Course Code	AMTCC0101	L T P	Credit
Course Title	Research Process &Methodology	3 0 0	3

Course Objective:

1	To explain the concept / fundamentals of research and their types	
2	To study the methods of research design and steps of research process	
3	To explain the methods of data collection and procedure of sampling techniques	
4	To analyze the data, apply the statistical techniques and understand the concept of hypothesis testing	
5	To study the types of research report and technical writing.	

Pre-requisites: Basics of Statistics

Course Contents / Syllabus

UNIT-I	INTRODUCTION TO RESEARCH	8 hours

Definition, objective and motivation of research, types and approaches of research, Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research methods versus Methodology, significance of research, criteria of good research.

UNIT-II	RESEARCH FORMULATION AND DESIGN	8 hours

Research process and steps involved, Definition and necessity of research problem. Importance and objective of Literature review, Locating relevant literature, Reliability of a source, Writing a survey and identifying the research problem, Literature Survey, Research Design , Methods of research design.

UNIT-III	DATA COLLECTION	8 hours

Classification of Data, accepts of method validation, Methods of Data Collection, Collection of primary and secondary data, sampling, need of sampling, sampling theory and Techniques, steps in sampling design, different types of sample designs, ethical considerations in research.

UNIT-IV	DATA ANALYSIS	8 hours

Processing Operations, Data analysis, Types of analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis Testing, Data processing software (e.g. SPSS etc.), statistical inference, Chi-Square Test, Analysis of variance(ANOVA) and covariance, Data Visualization – Monitoring Research Experiments ,hands-on with LaTeX.

UNIT-V	TECHNICAL WRITING AND REPORTING OF RESEARCH	8 hours

Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing, citation of Journals and Impact factor, Types of Indexing- SCI/SCIE/ESCI/SCOPUS/DBLP/Google Scholar/UGC-CARE etc. Significance of conferences and their ranking, plagiarism, IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, reproducibility and accountability.

Course outcome: Upon completion of the course, the student will be able to

CO 1	Explain concept / fundamentals for different types of research	K1
CO 2	Apply relevant research Design technique	K3
CO 3	Use appropriate Data Collection technique	K3
CO 4	Evaluate statistical analysis which includes various parametric test and non-parametric test and ANOVA technique	K5

CO 5	Prepare research report and Publish ethically.	K6

Text books

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE 2005.
3. Deepak Chawla, NeenaSondhi, Research Methodology, Vikas Publication

Reference Books

1. Donald Cooper & Pamela Schindler, Business Research Methods, TMGH, 9th edition
2. Creswell, John W. ,Research design: Qualitative, quantitative, and mixed methods approaches sage publications,2013

NPTEL/ You tube/ Faculty Video Link:

https://www.youtube.com/playlist?list=PL6G1C6j0WUTXqXL9O0CgTXCr1hL8HR2dY
https://www.youtube.com/playlist?list=PLVok63jpnHrFFQI6BqkIksVqDnYG0ZI41
https://www.youtube.com/playlist?list=PLnbm2MNkZYwOVVedGBQtID-jKgj9dD8kW
https://www.youtube.com/playlist?list=PLPjSqITyvDeWBBaFUbkLDJ0egyEYuNeR1
https://www.youtube.com/playlist?list=PLdj5pVg1kHiOypKNUmO0NKOfvoIThAv4N

Course Code	AMTCSE0151		LTP	Credit
Course Title	**Advanced Data Structures and Algorithms Lab**		**0 0 4**	**2**
Suggested list of Experiment				
Sr. No.	**Name of Experiment**			**CO**
1.	Implement Linear, Binary search, Bubble sort, Insertion sort, Selection sort and Radix Sort.			CO1
2.	Implement Merge sort, Quick sort and Heap sort.			CO1
3.	Implement Creation, Insertion, Traversal and Deletion operations in a Singly linked list.			CO2 CO4
4.	Implement Creation, Insertion, Traversal and Deletion operations in a Doubly linked list.			CO2 CO4
5.	Implement Creation, Insertion, Traversal and Deletion operations in a Circular linked list.			CO2 CO4
6.	Stack and Queue Implementation using linked list.			CO2,CO4
7.	Implement Tower of Hanoi using recursion.			CO4
8.	Implementation of Binary Tree and Tree Traversal			CO3
9.	Implementation of Binary Search Tree, Insertion and Deletion in BST.			CO3
10.	Graph Implementation of BFS, DFS.			CO3
11.	Graph Implementation of Minimum cost spanning trees.			CO3
12.	Graph Implementation of shortest path algorithm.			CO3
13.	Knapsack Problem using Greedy Solution			CO5
14.	Perform Travelling Salesman Problem			CO5
15.	Implement N Queen Problem using Backtracking			CO5
Lab Course Outcome: After completion of the lab students will be able to:				
CO 1	Implement various searching and sorting operations.			K3
CO 2	Implement data structures using dynamic memory allocation techniques.			K2,K3
CO 3	Explore and implement efficient data structure for a problem			K3
CO 4	Implement complex problems using multiple user defined functions.			K3
CO5	Implement optimization problems using various approaches			K3

M. TECH FIRST YEAR			
Course Code	**AMTCSE0152**	**L T P**	**Credit**
Course Title	**Artificial Intelligence Lab**	**0 0 4**	**2**
Suggested list of Experiments			
Sr. No.	**Name of Experiment**		**CO**
1.	Write a python program to implement simple Chat-bot.		CO1
2.	Implement Tic-Tac-Toe using A* algorithm.		CO1
3.	Implement alpha-beta pruning graphically with proper example and justify the pruning.		CO3
4.	Write a python program to implement Water Jug Problem.		CO3
5.	Use Heuristic Search Techniques to Implement Best first search (Best-Solution but not always optimal) and A* algorithm (Always gives optimal solution).		CO5
6.	Use Heuristic Search Techniques to Implement Hill-Climbing Algorithm.		CO5
7.	Write a program to implement Hangman game using python.		CO5
8.	Write a program to solve the Monkey Banana problem		CO5
9.	Write a python program to implement Simple Calculator program.		CO1
10.	Write a python program to POS (Parts of Speech) tagging for the given sentence using NLTK		CO2
11.	Solve 8-puzzle problem using best first search		CO5
12.	Solve Robot (traversal) problem using means End Analysis.		CO3, CO5
13.	Implementation of Image features Processing using OPENCV AND OPEN VINO		CO4
14.	Write a program to implement Naïve Bayes Algorithm		CO3
Lab Course Outcomes: After completion of this course students will be able to			
CO 1	Design simple application of AI.		K6
CO 2	Implement the Text Analysis algorithms.		K3
CO 3	Use the various algorithms of AI to solve real world problems.		K3
CO 4	Use the various OPEN SOURCE SOFTWARE tools for the implementation of Image Processing.		K3

M. TECH FIRST YEAR

Course Code	AMTAI0111	L	T	P	Credits
Course Title	Soft Computing	3	0	0	3

Course objectives:

The course covers the basic principles, techniques, and applications of soft computing. The course aims to develop the skills to design and implement Artificial Neural network, Fuzzy based system and optimized system using genetic algorithm for the real world problems.

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Introduction of Soft Computing, Soft computing vs. Hard computing; Various types, Techniques, Characteristics, Major Areas of Soft Computing. Introduction to MATLAB Environment for Soft computing Techniques.

UNIT-II	Neural Network	8 hours

Biological neurons and its working, Model of Artificial Neuron, Architectures, Taxonomy of ANN Systems, Various Activation Functions, Single Layer ANN System, Multi-Layer ANN System, Recurrent networks.   Supervised Learning, Unsupervised Learning, Reinforcement Learning, Perceptron, Adaline, Madaline, Applications of ANN in research, MATLAB Neural Network Toolbox.

UNIT-III	Fuzzy Systems	8 hours

Fuzzy Set theory, Operations on Fuzzy sets, Properties of Fuzzy sets, Fuzzy versus Crisp set, Fuzzy Relation, Operations on Fuzzy Relation, Properties of Fuzzy Relation, Fuzzy versus Crisp Relations, Introduction & features of membership functions, Max-Min Composition

UNIT-IV	Fuzzy logic modeling	8 hours

Introduction to Fuzzy logic, Fuzzy Propositions, Fuzzy If-Then Rules, implications and inferences. Fuzzy Rule based systems, Fuzzy Predicate logic, Fuzzy Inference Systems, Fuzzification, Defuzzification Method, Fuzzy logic controller design, applications of Fuzzy logic, Fuzzy Logic MATLAB Toolbox

UNIT-V	Genetic Algorithm	8 hours

Fundamentals of Genetic Algorithms, Basic concepts, Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Optimization of traveling salesman problem using Genetic Algorithm, Genetic Algorithm MATLAB Toolbox, Hybrid Soft Computing.

Course outcomes: After completion of this course students will be able to

CO 1	Discuss types, characteristics and applications of soft computing techniques.	K2
CO 2	Analyze and design artificial neural network with different types of learning techniques to solve complex problem.	K4, K6
CO 3	Translate problems in fuzzy relation and apply membership function on it.	K2, K3
CO 4	Explain fuzzy logic and design fuzzy based system to solve real world problems.	K2, K6
CO 5	Discuss the concept of genetic algorithm and its various applications.	K2

Text books

1. S. N. Sivanandam , S. N. Deepa, Principles of Soft Computing, 2011, 2ndedition, Wiley
2. S. Rajasekaran, G.A. VijayalakshmiPai, Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications, 2017, PHI Learning; 2nd Revised edition.
Reference books
1. Goldberg, Genetic Algorithms, 2008, Pearson Education India, 1st edition
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3ed Paperback – 1 January 2011, Wiley, Third edition
3. LaureneFausett, Fundamentals of Neural Networks: Architectures, Algorithms and Applications,2004, Pearson Education India; 1st edition.
NPTEL/ Youtube/ Faculty Video Link:
https://nptel.ac.in/courses/106/105/106105173/ **https://nptel.ac.in/courses/106/105/106105173/** **https://nptel.ac.in/courses/106/105/106105173/** **https://nptel.ac.in/courses/106/105/106105173/** **https://nptel.ac.in/courses/106/105/106105173/**

M. TECH FIRST YEAR			

Course Code	AMTAI0112	**L T P**	**Credits**
Course Title	**Introduction to IOT**	**3 0 0**	**3**

Course objective:

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.

Pre-requisites: Sensors, System Integration, Cloud and Network Security

Course Contents / Syllabus		
UNIT-I	**Introduction toIOT**	**8 hours**
Vision, Definition, Characteristics of IOT, Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.		
UNIT-II	**Hardware for IOT**	**8 Hours**
Sensors, Digital sensors, Transducer, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.		
UNIT-III	**Network & Communication Aspects in IOT**	**8 Hours**
Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination **Application Protocols:** MQTT, REST/HTTP, CoAP. Low range protocols: BLE, ZigBee. Long range protocols: LoRa, SigFox, NB-IOT.		
UNIT-IV	**Programming the Ardunio and Raspberry Pi**	**8 Hours**
Ardunio platform boards anatomy, ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IOT. Programming the Raspberry Pi. Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.		
UNIT-V	**Challenges in IOT Design and IOT Applications**	**8 Hours**
Development challenges, Security challenges, Other challenges. Smart metering, e-health, city automation, automotive applications, home automation, smart cards, Communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.		

Course outcome: After completion of this course students will be able to

CO 1	Describe vision, definition, conceptual framework, architecture of IOT and M2M Communication.	K1
CO 2	Explore Sensors, actuators and embedded plat forms used in IOT implementation.	K2
CO 3	Operate the hardware with network and basic knowledge about network protocols and data dissemination.	K3, K2
CO 4	Develop programming aspects needed for Interfacing between hardware and Software.	K6
CO 5	Analyze applications like Smart metering system, Smart street lights, home automation and M2M applications.	K4

Text books

1. Michael Miller "The Internet of Things", 1st Edition, 2015, Pearson.
2. Raj Kamal "INTERNET OF THINGS", 1st Edition, 2016, McGraw-Hill.

3.	Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", 2nd Edition, 2016, Mc Graw Hill.
4.	Jeeva Jose, "Internet of Things", 1st Edition 2018 Khanna Publications.

Reference Books	
1.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, 2014, VPT.
2.	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, 2013, Apress Publications.
3.	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, 2014, Academic Press. (ISBN-13: 978-0124076846).

NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=jbMWEEdq3Kg
Unit 2	https://www.youtube.com/watch?v=SA8_4oSStiQ
Unit 3	https://www.youtube.com/watch?v=fByKuk2VmJc
Unit 4	https://www.youtube.com/watch?v=TbHsOgtCMDc
Unit 5	https://www.youtube.com/watch?v=OfGxbxUCa2k

M. TECH FIRST YEAR			
Course Code	**AMTCSE0111**	**L T P**	**Credit**
Course Title	**Cloud Computing**	**3 0 0**	**3**

Course Objective:

1	To introduce the concept of cloud computing & their technologies.
2	Tounderstand the different cloud computing services & storage
3	To gain sound knowledge of resource management and security in cloud.
4	To understand the component of Google cloud platform.

Pre-requisites: Basics of Connecting devices

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 HOURS**

Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud, On-demand Provisioning, EC2 Instances and its types.

UNIT-II	**Cloud Enabling Technologies:**	**8 HOURS**

Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery, Case study on virtualization

UNIT-III	**Cloud Architecture, Services and Storage:**	**8 HOURS**

Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, laaS, PaaS and SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers – S3, RDS, EBS.

UNIT-IV	**Resource Management & Security In Cloud**	**8 HOURS**

Inter Cloud Resource Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards, VPC, security issues in Cloud.

UNIT-V	**Case Studies and Advancements**	**8 HOURS**

Case Study on open Source and Commercial: Eucalyptus, Microsoft Azure, Amazon EC2, Case Study on App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation, case study on vmware, virtualization, case study on Fog computing

Course outcome: **After completion of this course students will be able to**

CO 1	Understand cloud computing and different service models.	K1, K2
CO 2	Describe importance of virtualization along with their technologies.	K2
CO 3	Use and Examine different cloud computing services.	K2, K3
CO 4	Manage resources and apply security features in cloud.	K3, K5
CO 5	Analyze the components of open stack & Google, Azure and AWS Cloud platform.	K4

Text books

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed And Cloud Computing, From

	Parallel Processing To The Internet Of Things", Morgan Kaufmann Publishers, 2012.
2.	Ritting house, John W., And James F. Ransome, ―Cloud Computing: Implementation, Management And Security, CRC Press, 2017.
3.	Raj kumarBuyya, Christian Vecchiola, S. Thamaraiselvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

Reference Books

1.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
2.	George Reese, "Cloud Application Architectures: Building Applications And Infrastructure In The Cloud: Transactional Systems For EC2 And Beyond (Theory In Practice), O'Reilly, 2009**.**

NPTEL/ Youtube/ Faculty Video Link:

M. TECH FIRST YEAR

Course Code	AMTCSE0112	L T P	Credit
Course Title	Advanced Operating Systems	3 0 0	3

Course objective:

1	To learn the fundamentals of advanced operating Systems.
2	To understand what a process is and how processes are synchronized
3	To understand different approaches to memory management
4	Students should be able to use system calls for managing processes, memory and the file system.
5	To understand the structure and organization of the file system.

Pre-requisites:

1	Basic knowledge of computer fundamentals.
2	Basic knowledge of computer organization.
3	Basic knowledge of Operating system

Course Contents / Syllabus

UNIT-I	Introduction of Operating System	8 hours

Introduction To Operating Systems, Types Of Operating Systems, Operating System Structures. Operating System Services, System Calls, Virtual Machines, Operating System Design And Implementation ,Types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS)

UNIT-II	Inter Process Communication	8 hours

Race conditions, critical regions, Mutual Exclusion with busy waiting, sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing; Scheduling- scheduling in batch systems, Interactive systems, Real time systems, Thread scheduling

UNIT-III	Deadlocks and Distributed Operating Systems	8 hours

Deadlocks-Introduction, Deadlock Detection and Recovery – Deadlock Detection with one resource of each type, with multiple resource of each type, recovery from deadlock; Deadlock Avoidance, Deadlock Prevention.

UNIT-IV	Memory and Device Management	8 hours

Introduction, Swapping, Paging, Virtual memory – Demand paging, page replacement Algorithms; File System Management- Organization of File System, File Permissions, MS DOS and UNIX file system case studies, NTFS; Device Management- I/O Channels, Interrupts and Interrupt Handling, Types of device allocation

UNIT-V	Distributed Operating Systems	8 hours

Distributed operating system concept – Architectures of Distributed Systems, Distributed Mutual Exclusion, Distributed Deadlock detection, Agreement protocols, Threads, processor Allocation, Allocation algorithms , Distributed File system design; Real Time Operating Systems: Introduction to Real Time Operating Systems, Concepts of scheduling , Real time Memory Management
Case studies :Linux kernel-X86 architectures
Advance topics for research: Virtualization,cgroups,namespaces,RBAC,containers,RDMA,Rackscale computing

Course outcome: After completion of this course students will be able to

CO 1	Understand the structure, functions and type of OS.	K2
CO 2	Implement the requirement for process synchronization and coordination handled by operating system	K2

CO 3	Understand deadlock concepts and implement prevention and avoidance algorithms	K2,K3
CO 4	Describe and analyze the memory management and its allocation policies and understand File systems	K2, K4
CO 5	Understand the concept of distributed and real time OS.	K2

Text books

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts",Wiley
2. Mukesh Singhal and Niranjan, "Advanced Concepts in Operating Systems", TMH
3. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education

Reference Books

1. Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education
2. Pradeep K. Sinha, "Distributed Operating Systems and concepts", PHI
3. Harvey M Dietel, " An Introduction to Operating System", PearsonEducation
4. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=783KAB-tuE4
Unit 2	https://www.youtube.com/watch?v=3Eaw1SSIqRg&t=45s
Unit 3	https://www.youtube.com/watch?v=_zOTMOubT1M&t=34s
Unit 4	https://www.youtube.com/watch?v=Tak822Wz4x4
Unit 5	https://www.youtube.com/watch?v=-OTP2O-UhhI

M. TECH FIRST YEAR			
Course Code	AMTCY0111	**L T P**	**Credit**
Course Title	**Advanced Security of Networked Systems**	**3 0 0**	**3**

Course objective : The objective of the course are

1	Introduce Advanced topic of computer networks and Security to the students with the eye on future trends.
2	To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
3	Apply design principles of authentication systems.
4	Compare the key management problems for symmetric cryptography-based and asymmetric cryptography-based security protocols.
5	Compare the unique security challenges in wireless networks; apply various wireless network security standards.

Pre-requisites: Basics of networking and cryptography

Course Contents / Syllabus

UNIT-I	**INTRODUCTION TO NETWORK SECURITY**	**8**

Network Security Model, Types of Attack, Overview of Most Common Security Issues,
Linux Security Overview, Password Attack, Dictionary Attack - Thwarting dictionary attack,
IPTables, Using iptables to thwart dictionary attack, Password Cracking - Hashing overview,
Lookup tables, Introduction to Rainbow Table, Modern Linux Password Hashing Scheme,

UNIT-II	**MALWARE AND VIRUSES**	**8**

Malware - Virus Infection Techniques, Anatomy of a Virus, Virus Propagation,
Classification of Viruses based on Infection Techniques, Memory Strategies etc., Defense Against Viruses,
Worms, (Case Study Morris Worm &Conficker worm), Malware analysis,Static and Dynamic Malware
analysis.

UNIT-III	**APPLICATION VULNERABILITIES**	**8**

Application Vulnerabilities – Smashing the Stack for Fun and Profit, Format string attack,
SQL Injection, XSS, Authentication- Overview of Authentication, Need for Key Distribution
Centers, Authentication & Key Distribution Protocols - Needham Schroeder, Kerberos, Random Number
Generation-Psuedo and True random number generators, Cryptographically Secure PRNGs – The Blum
BlumShub Generator, PRNG – Linear
Congruential Generators, Entropy - software and hardware, Message Authentication Codes

UNIT-IV	**ADVANCED TCP/IP**	**8**

TCP/IP Vulnerabilities- TCP Overview - Connection Setup/Teardown, Packet Sniffing, Detecting Sniffers
on your network, IP Spoofing, ARP Poisoning, UDP Hijacking, Fragmentation Attack- Ping of Death,
Evasion & Denial of Service, UDP Hijacking, TCP Spoofing, TCP Hijacking - Mitnick attack, Joncheray
attack, SYN Flood Attack, Denial of Service Attack, Port Scanning Techniques

UNIT-V	**WIRELESS SECURITY AND FIREWALL**	**8**

DNS – DNS Zones, Zone Transfer, BIND, DNS Spoofing, DNS Cache Poisoning, IPSec –
Introduction, Tunnel & Transfer Modes, IPSec Authentication Header, Encapsulating
Security Header and Payload, IPSec Key Exchange, VPNs SSL/TLS For Secure Web Services – SSL
Connection & SSL Session, SSL Connection State, SSL Session State, SSL Record Protocol, SSL
Handshake Protocol, TOR Protocol for Anonymous Routing
Firewalls – Packet-filtering, Stateless and stateful, Intrusion Detection using SNORT, NAT Others – Email
Spam and solutions, Wireless Security Overview, Cipher Text Attacks

Course outcome: After completion of this course students will be able to

CO 1	Identify, analyse and apply best practice for security systems that are currently used or currently being developed towards standardisation of network systems	K2 ,K4
CO 2	Define exact properties and requirements of security solutions for network systems	K1

CO 3	Analyse and identify vulnerabilities, threats and attacks against a number of modern or new network systems	K4,K1
CO 4	Analyse general security mechanisms qualitatively and quantitatively	K4
CO 5	Design and analyse security protocols, mechanisms, and architectures that protect the network operation against attacks	K6,K4

Text books

1. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Second Edition, Prentice Hall, 2002.
2. Eric Rescoria, "SSL and TLS : Designing and Building Secure Systems, Addison-Wesley Professional, 2000.
3. Kaufman, Perlman and Speciner. Network Security: Private Communication in a Public World

Reference Books

1. Stephen Kent, Charles Lynn, Joanne Mikkelson, and Karen Seo, Secure Border Gateway Protocol (S-BGP)-Real World Performance and Deployment Issues, NDSS,2000.
2. Proctor Paul, The Practical Intrusion Detection Handbook, Third Edition, Prentice-Hall, Englewood Cliffs, 2001.
3. Stevens. TCP/IP Illustrated, vol. 1, the protocols.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	By NPTEL IIT MADRAS :https://www.youtube.com/watch?v=fQ3ESFfvchg&list=PLUtfVcb-iqn834VGI9faVXGIGSDXZMGp8
Unit 2	https://www.youtube.com/watch?v=f-fMdnUW4X4
Unit 3	https://www.youtube.com/watch?v=3Snh3C52kSw
Unit 4	TCP Spoofing :https://www.youtube.com/watch?v=bVYHNO_tvTc ARP Poising :https://www.youtube.com/watch?v=RTXAUJ2yqCg
Unit 5	https://www.youtube.com/watch?v=q3MwN9R0Br4&t=s

M. TECH FIRST YEAR

Course Code		AMTCY0112	L T P	Credits
Course Title		**Fundamentals of Data Science and Applications**	3 0 0	3

Course objective:	
1	Develop practical data analysis skills, which can be applied to practical problems.
2	Develop fundamental knowledge of concepts underlying data science projects.
3	Develop practical skills needed in modern analytics.
4	Explain how math and information sciences can contribute to building better algorithms and software
5	Develop applied experience with data science software, programming, applications and processes.

Pre-requisites: Basic knowledge of statistics, linear algebra.

Course Contents / Syllabus

UNIT-I	**INTRODUCTION TO DATA**: Data Stores - Introduction to Structured Data, DBMS Concepts, RDBMS (Oracle/MySQL), NoSQL Concepts, Mongo, Cassandra, Basic to complex Querying in SQL. (Lab Element), Query tuning.,	**8**
UNIT-II	**DATA ANALYSIS TECHNIQUES / STAGES:** Introduction to Unstructured Data, Taming Unstructured Data. Understanding Data - Understanding data formats (XML, JSON, YAML, PMML), Data feeds (RSS, Atom, RDF), Preparing Data - Data Analysis/Profiling, Data Cleansing.	**8**
UNIT-III	**DATA WAREHOUSING AND LEARNING ALGORITHMS:** OLTP & OLAP - Fundamentals of Data Warehousing, Dimension Modelling. Slowly Changing Dimensions, ETL Process, Performance Tuning of warehouse Loads, Data Analytics Fundamentals, Pre Processors, Post Processors Supervised Learning - Linear/Logistic Regression, Decision Tree, Naïve Bayes Unsupervised Learning, K-Means, Association Rules, Hands on implementation of the basic algorithms.	**8**
UNIT-IV	**HADOOP THEORY:** Introduction to Hadoop, Map-Reduce. Hadoop Theory and hands on implementation, MR coding, Basic Management and Monitoring of Hadoop Cluster, Implementation of K-meansalgorithm using MR.	**8**
UNIT-V	**DATA ANALYTICS:** Introduction to Streaming Data Analytics, Introduction to Spark, Introduction to Storm, Introduction to Scala.Case study of Walmart Sales Forecasting Data Set, Boston Housing Data Set.	**8**

Course outcome: After completion of this course students will be able to		
CO 1	Discuss basic notions and definitions in data analysis, machine learning.	K2
CO 2	Explain standard methods of data analysis and information retrieval	K1,K2

CO 3	Analyse the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods.	K4
CO 4	Solve a real-world problem using mathematical equations.	K3
CO 5	Evaluate to develop complex analytical reasoning.	K5

Text books

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013.

2. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.

3. Hastie, T., Tibshirani, R., Friedman, J. The Elements of Statistical Learning, 2nd edition. Springer, 2009.

Reference Books

1. C. O'Neil, and R. Schutt, Doing Data Science – Straight Talk from Frontline Tom Michael, Machine Learning, McGraw Hill, 1997.

2. T. Hastie, R. Tibshirani and J. Friedman, Elements of Statistical Learning – Data Mining, Inference, Prediction, Springer, 2003.

3. Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012.

NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=uwCR9We3JHw
Unit 2	https://www.youtube.com/watch?v=aQVDhxE1-sE https://www.youtube.com/watch?v=WBU7sW1jy2o
Unit 3	https://www.youtube.com/watch?v=CHYPF7jxlik
Unit 4	https://www.youtube.com/watch?v=Pq3OyQO-l3E
Unit 5	https://www.youtube.com/watch?v=fWE93St-RaQ https://www.youtube.com/watch?v=VSbU7bKfNkA

M. TECH FIRST YEAR			
Course Code	**AMTAI0113**	**L T P**	**Credit**
Course Title	**Pattern Recognition**	**3 0 0**	**3**

Course objectives:

The course facilitate students to understand the concept of a pattern and basic approach to the development of pattern recognition and machine intelligence algorithms. It aims to help students understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 hours**

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation, multilayer perceptron, least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.

UNIT-II	**Statistical Pattern Recognition**	**8 hours**

Introduction, Bayesian Decision Theory-Continuous Features, Minimum-Error-Rate Classification, Classifiers, Discriminant Functions, and Decision Surfaces, The Normal Density, Discriminant Functions for the Normal Density, Error Probabilities and Integrals, Error Bounds for Normal Densities, Bayes Decision Theory-Discrete Features, Missing and Noisy Features, Bayesian Belief Networks, Compound Bayesian Decision Theory and Context.

UNIT-III	**Parameter estimation methods/ Linear Classifiers**	**8 hours**

Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm , Least Squares Methods, Mean Square Estimation Revisited: , Logistic Discrimination, Support Vector Machines Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis, Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

UNIT-IV	**Non-parametric Techniques and Non Linear Classifiers**	**8 hours**

The XOR Problem , The Two-Layer Perceptron , Three-Layer Perceptrons, Algorithms Based on Exact Classification of the Training Set , Implementation of Backpropagation Algorithm , Variations on the Backpropagation Theme, The Cost Function Choice, Choice of the Network Size, A Simulation Example , Networks with Weight Sharing, Generalized Linear Classifiers, Capacity of the l-Dimensional Space in Linear Dichotomies, Polynomial Classifiers, Radial Basis Function Networks, Universal Approximators, Support Vector Machines: The nonlinear Case, Decision Trees, Combining Classifiers, The Boosting Approach to Combine Classifiers.

UNIT-V	**Pattern Classifier**	**8 hours**

Feature Generation: Linear Transforms, Regional Features, Features for Shape and Size, Characterization, Typical Features for Speech and Audio Classification Template Matching: Introduction, Similarity Measures Based on Optimal Path Searching, Techniques, Measures Based on Correlations, Deformable Template Models, Context Dependent Classification: Markov Chain Models, Hidden Markov Models,Clustering Algorithms: Clustering Algorithms Based on Graph Theory, Competitive LearningAlgorithms: Supervised Learning Vector Quantization ,Study of Mistake Bound Model of Learning.

Case Study: Evaluate the temperature , value of the Stock: Regression, Score of player in the upcoming Test Match, prediction of rain ,COVID-19 tests positives or negatives

Course outcomes: After completion of this course students will be able to		
CO 1	Understand the fundamentals of pattern recognition and its relevance to classical and modern problems.	K2

CO 2	Apply Maximum-likelihood parameter estimation in relatively complex probabilistic models.	K3
CO 3	Implement estimation method and various models.	K3
CO 4	Apply the non parametric techniques like KNN and clustering etc.	K3
CO 5	Understand the unsupervised learning and clustering technique.	K2

Text books

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, 2006, John Wiley.

2. C. M. Bishop, "Pattern Recognition and Machine Learning", 2009, Springer.

3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, 2009, Academic Press.

Reference Books

1. Pattern Recognition, NarasimhaMurty,Susheela Devi, 2011, Universities Press.

2. Pattern Recognition and Image Analysis, Gose, Johnson baugh&Jost, 1996, PHI Learning.

NPTEL/ Youtube/ Faculty Video Link:

https://nptel.ac.in/courses/106/106/106106046/

https://nptel.ac.in/courses/117/106/117106100/

https://nptel.ac.in/courses/117/108/117108048/

https://nptel.ac.in/courses/106/108/106108057/

https://nptel.ac.in/courses/117/105/117105101/

M. TECH FIRST YEAR

Course Code	AMTAI0114	L T P	Credit
Course Title	Information Retrieval	3 0 0	3

Course objectives:

This course aims to teach basic concepts, tools & techniques in the field of Information Retrieval (IR) & Search. It focuses on theoretical foundations, implementation aspects, representation, organization, indexing, categorization as well as current trends and research issues in the area of Information Retrieval.

Pre-requisites:

- Basic understanding of Linear Algebra and Probability.
- Basic understanding of any programming language.

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Text analysis, Types of text analysis, Information retrieval, IR system architecture: Text processing, Indexes and query matching; Text processing: Text format, Tokenization, stemming, lemmatization, Language modeling, Examples of open source IR Systems, Query processing models. Probabilistic models (Binary independence model, Robertson/Spark Jones weighting formula, Two-Poisson model), Relevance feedback (Term selection, Pseudo relevance feedback).

UNIT-II	Language models	8 hours

Unigram, Bigram language models, generating queries from documents, Language models and smoothing, ranking with language models, KullbackLeibler divergence, Divergence from randomness, Passage retrieval and ranking. Management of Information Retrieval Systems: Knowledge management, Information management, Digital asset management, Network management, Search engine optimization, Records compliance and risk management, Version control, Data and data quality, Information system failure.

UNIT-III	Information retrieval systems	8 hours

Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system (GIS). Indexing: Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction.

UNIT-IV	Query processing for ranked retrieval and Compression	8 hours

General-purpose data compression, Symbol-wise data compression, compressing posting lists, Compressing the dictionary; Information categorization and filtering: Classification, Probabilistic classifiers, linear classifiers, Similarity-based classifiers, Multi category ranking and classification, learning to rank, Introduction to the clustering problem, Partitioning methods, Clustering versus classification, Reduced dimensionality/spectral methods.

UNIT-V	Sentiment Analysis	8 hours

Introduction to sentiment analysis, Document-level sentiment analysis. Sentence-level sentiment analysis, Aspect-based sentiment analysis; Comparative sentiment analysis, baseline algorithm, Lexicons, Corpora, Introduction to different Tools of Sentiment analysis and Applications.

Course outcomes: After completion of this course students will be able to

CO1	Describe the different information retrieval modelsand compare their weaknesses and strengths.	K2, K4
CO2	Apply mathematical models and algorithms of statistical Natural Language Processing (NLP).	K3
CO3	Understand the standard methods for Web indexing and retrieval	K2
CO4	Compare different search engine ranking techniques.	K4

CO5	Demonstrate indexing, compression, information categorization and sentiment analysis.	K3

Text books

1. Butcher S., Clarke C.L.A. and Cormack G., Information Retrieval, 1st Edition, The MIT Press 2010. ISBN 978

2. Bates M.J., Understanding Information Retrieval Systems, 1st Edition,2011, CRC press, ISBN 978

3. Manning C.D., Raghavan P. and Schütze H., Introduction to Information Retrieval, 1st Edition, 2008, Cambridge University Press, ISBN 978-0521865715.

Reference Books

1. SoumenCharabarti, Mining the Web, Morgan-Kaufmann, 1st Edition, 2002, Morgan-Kaufmann PublishersISBN: 9780080511726

2. Baeza-Yates R., Ribeiro-Neto B., Modern Information Retrieval, 1st Edition, 1999, Addison-Wesley Longman Publishing Co., Inc ISBN:978-0-201-39829-8

NPTEL/ Youtube/ Faculty Video Link:

https://www.youtube.com/playlist?list=PL0ZVw5-GryEkGAQT7lX7oIHqy

https://nptel.ac.in/courses/106/101/106101007/

https://www.cse.iitk.ac.in/pages/CS657.html

http://web.stanford.edu/class/cs276/

	M. TECH FIRST YEAR		
Course Code	AMTCSE0113	**L T P**	**Credit**
Course Title	**Distributed Computing**	**3 0 0**	**3**
Course objective:			
1	To introduce fundamental principles of distributed systems, technical challenges and key design issues		
2	To impart knowledge of the distributed computing models, algorithms and the design of distributed system.		
3	To be familiar with the fundamentals of the architecture, operating systems, and compilers, and their performance implications in parallel computing systems		
4	To implemented parallel applications on modern parallel computing systems, and be able to measure, tune, and report on their performance		
5	Practice in distributed computing through in-depth communication and synchronization, processes, distributed algorithms, naming, consistency and replication, fault tolerance and security.		

Pre-requisites:

- knowledge of basic computer organization are required
- Good knowledge about the distributed systems and operating systems.

	Course Contents / Syllabus	
UNIT-I	**Introduction**: Distributed System, Theory of Distributed Computing, Basic Algorithms in Message Passing Systems, Formal Models for Message Passing System, Broadcast and Converge cast on a Spanning Tree, Flooding and Building a Spanning Tree, Constructing a Depth-First Search Spanning Tree, Leader Election in Rings, The Leader Election Problem, Asynchronous and Synchronous Rings	**8**
UNIT-II	**Mutual Exclusion in Shared Memory**: Introduction, The Mutual Exclusion Problem, Mutual Exclusion Using Powerful Primitives, Mutual Exclusion Using Read/Write Registers **Fault Tolerance**: Synchronous System with Crash Failures, Synchronous Systems with Byzantine Failures, Impossibility in Asynchronous Systems, Causality and Time, Clock Synchronization	**8**
UNIT-III	**Broadcast** : Introduction, Broadcast Services, Multicast in Groups, Replication **Distributed Shared Memory**: Introduction, Linearizable Shared Memory, Sequentially Consistent Memory, Algorithms for Shared Memory,	**8**
UNIT-IV	**Failure Detector**: Introduction, Unreliable Failure Detectors, The Consensus Problem, Atomic Broadcast, Agreement Problem, Failure Detection Protocol	**8**
UNIT-V	**PEER TO PEER Computing and Overlay Graph**: Introduction, Data Indexing, Overlays, Chord Distributed Hash Table, Content Addressable Networks, Graph Structure of Complex Networks, Internet Graph,	**8**

	Generalized Random Graph Networks, Evolving Networks Case study on MapReduce,Distributed Algorithms for Sensor Networks,Authentication in Distributed systems,Bitcoin:A Peer –to-peer Electronic cash system	

Course outcome: **After completion of this course students will be able to**

CO 1	Distinguish distributed computing paradigm from other computing paradigms	K2
CO 2	Identify the core concepts of distributed systems	K2
CO 3	Illustrate the mechanisms of inter process communication in distributed system	K3
CO 4	Apply appropriate distributed system principles in ensuring transparency consistency and fault-tolerance in distributed file system	K3
CO 5	Identify the need for overlay graph and networks in distributed systems	K2

Text books

1. George Coulouris, Jean Dollimore and Tim Kindberg , Distributed Systems:Concepts and Design, Fifth Edition , Pearson Education, 2011
2. Pradeep K Sinha, Distributed Operating Systems : Concepts and Design, Prentice Hall of India
3. Ajay D. Kshemkalyani, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press 2008

Reference Books

1. A S Tanenbaum and M V Steen , Distributed Systems: Principles and paradigms, Pearson Education, 2007

1. HagitAttiya, Distributed Computing: Fundamentals, Simulations, and Advanced Topics, 2004

3 M Solomon and J Krammer, Distributed Systems and Computer Networks, PHI

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://nptel.ac.in/courses/106/106/106106107/
Unit 2	https://www.youtube.com/watch?v=ipm5hDz9zG0
Unit 3	https://www.youtube.com/watch?v=63M6vaCXQ3c
Unit 4	https://www.youtube.com/watch?v=KaG0JBnRmCA&t=8s
Unit 5	https://www.youtube.com/watch?v=GYrvRCtIZz4

M.TECH FIRST YEAR

Course Code	AMTCSE0114	L T P	Credit
Course Title	**Data Warehousing & Data Mining**	**3 0 0**	**3**

Course objective:

1	To understand the fundamentals of Data Warehousing and Mining.
2	To understand and implement classical models and algorithms in data warehouses and data mining
3	To understand and apply various classification and clustering techniques using tools.
4	To develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Contents / Syllabus

UNIT-I	**INTRODUCTION**	8

Overview of Database System, Database Language, data model and language, normalization, Introduction to Concurrency Control and deadlock.
Data Warehousing and Business Analysis: Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT-II	**Data Mining**	8

Data Mining Functionalities – Data Pre-processing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint Based Association Mining.

UNIT-III	**Classification and Prediction**	8

Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor , Ensemble Methods, Model Section.

UNIT-IV	**Cluster Analysis**	8

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods. Grid-Based Methods, Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint Based Cluster Analysis, Outlier Analysis.

UNIT-V	**Mining Object, Spatial, Multimedia, Text and Web Data**	8

Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Temporal Mining the World Wide Web, Business and scientific application of data mining, Introduction to Data Mining tools: Weka, Rapid Miner, KEEL, SPSS

Course outcome: After completion of this course students will be able to

CO 1	Understand the functionality of the various data mining and data warehousing component	K1, K2
CO 2	Apply frequent pattern and association rule mining techniques for data analysis	K3
CO 3	Identify and apply appropriate data mining algorithms to solve real world problems	K1, K3

CO 4	Compare and evaluate different clustering methods	K4
CO 5	Describe complex data types with respect to spatial, web and text mining.	K1

Text books

1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann Publishers Third Edition, 2012

2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, Tenth Reprint 2007.

3. G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

Reference Books

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

2. Soman K.P., Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

3. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=CHYPF7jxlik
Unit 2	https://www.youtube.com/watch?v=VCQUJlNPdOc
Unit 3	https://www.youtube.com/watch?v=gkagE_fE2sk
Unit 4	https://www.youtube.com/watch?v=icRnW0o5haI
Unit 5	https://www.youtube.com/watch?v=IhFkNmVmwn4

M. TECH FIRST YEAR

Course Code	AMTCY0113	L T P	Credit
Course Title	**Mobile Wireless Networks and Security**	3 0 0	3

Course objective:

1	To understand the basic concepts of mobile computing.
2	To learn the basics of mobile telecommunication system
3	To get aware of growing threats to mobile devices, networks and services delivered over the mobile infrastructure.
4	To get good conceptual overview of the security principles incorporated in the design of several generations of mobile networks.
5	To provide a comprehensive overview of all relevant aspects of security in mobile and wireless networks and also to introduce to students new, advanced research topics.

Pre-requisites: Basic and advanced principles of computer security,Security protocols and architectures for wired networksSecurity architecture for open distributed systems, Undergraduate level knowledge of computer systems and networks.

Course Contents / Syllabus

UNIT-I	**Introduction to Mobile Security**	8 Lectures

Mobile Computing Models, Design and Implementation, Mobile Architecture, Service Discovery protocol, Mobile P2P systems, Mobile Networking, Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc.

UNIT-II	**Security in Mobile Computing**	8 Lectures

Building Blocks – Basic security and cryptographic techniques, Security of GSM Networks, Security of UMTS Networks, LTE Security, WiFi and Bluetooth Security, SIM/UICC Security, Privacy,Application Security, Execution transparency

UNIT-III	**Security in Smart Phones**	8 Lectures

Mobile Malware and App Security Information flow tracking, Android Security Model, IOS Security Model ,Security Model of the Windows Phone, SMS/MMS, Mobile Geolocation and Mobile Web Security, Security of Mobile VoIP Communications, Emerging Trends in Mobile Security

UNIT-IV	**Situation and Location Awareness**	8 Lectures

Situation Awareness: Situation Models,Modelling situation awareness, Modelling Context and User; **Location awareness:** Indoor localization – Radar, Horus, Outdoor localization – Global Positioning Satellite, Assisted Global Positioning Satellite.

UNIT-V	**Context-Aware Computing**	8 Lectures

Context modelling, Ontological based approach, Context Reasoning, Context-aware systems, Middleware in Context Aware Computing, Context-aware security, Proactive Computing.

Course outcome: After completion of this course students will be able to

CO 1	Explain the need for security protocols in the context of Mobile communication.	K2
CO 2	Examine, and inspect different attacks on Mobile Applications and Web services.	K4
CO 3	Interpret the concept of vulnerabilities, attacks and protection mechanisms.	K2
CO 4	Understand appropriate security policies to protect Mobile infrastructure	K2

	components	
CO 5	Examine various security issues in Android platform.	K4

Text books

1. Mobile Application Security, Himanshu Dviwedi, Chris Clark and David Thiel, 1st Edition

2. Security of Mobile Communications, Noureddine Boudriga, 2009

Reference Books

1. F. Adelstein, S.K.S. Gupta, G.G. Richard III and L. Schwiebert, *Fundamentals of Mobile and Pervasive Computing*, McGraw Hill, ISBN: 0-07-141237-9, 2005.

2. Mobile Device Security: A Comprehensive Guide to Securing Your Information in a Moving Worldby Stephen Fried

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=5kBknJWi71Q
Unit 2	https://www.youtube.com/watch?v=PnAN9mvGVVY
Unit 3	https://www.youtube.com/watch?v=HAYk7fVaMGM https://www.youtube.com/watch?v=_rFKaSSFHEA
Unit 4	https://www.youtube.com/watch?v=G6QH639A014
Unit 5	https://www.youtube.com/watch?v=jYnViOb2K4A

M. TECH FIRST YEAR			
Course Code	**AMTCY0114**	**L T P**	**Credit**
Course Title	**Object Oriented Software Engineering**	**3 0 0**	**3**

Course objective:

1	To learn and understand various O-O concepts along with their applicability contexts.
2	To learn various modeling techniques to model different perspectives of object-oriented software design (UML) and how to identify and model/represent domain constraints on the objects and (or) on their relationships
3	To develop and design solutions for problems on various O-O concepts
4	Document your requirements, analysis, and design models in the Unified Modeling Language (UML) notation. And apply techniques of state machines and design patterns to your designs.
5	To discuss various software testing issues and solutions in software unit test, integration and system testing. And to expose the advanced software testing topics, such as object-oriented software testing methods.

Pre-requisites:

- Basic understanding of the software development life cycle (SDLC).
- Basic understanding of software programming using any programming language.

Course Contents / Syllabus

UNIT-I		8

Object Oriented Concepts and Modelling :What is Object Orientation(Introduction to class, Object, inheritance, polymorphism) Model: Importance of Modelling, Object Oriented Modelling, Object oriented system development: Function/data methods, Object oriented analysis, Object oriented construction, Object oriented testing, Identifying the elements of an object model: Identifying classes and objects, Specifying the attributes, Defining operations, Finalizing the object definition

UNIT-II		8

 Introduction to UML :Overview of UML ,Conceptual Model of UML , Architecture , S/W Development Life Cycle, Basic and Advanced Structural Modelling: Classes Relationship, Common mechanism, Diagrams, Class diagram , Advanced classes, Advanced Relationship, Interface, Types and Roles, Packages, Object Diagram Basic, Behavioural Modelling: Interactions , Use cases, Use Case Diagram , Interaction Diagram, Activity Diagram ,State chart Diagram, Architectural Modeling: Component , Components Diagram ,Deployment Diagram

UNIT-III		8

 Object Oriented Design: Generic components of OO Design model ,System Design process: Partitioning the analysis model , Concurrency and subsystem allocation ,Task Mgmt component, Data Mgmt component , Resource Mgmt component , Inter sub-system communication, Object Design process

UNIT-IV		8

Object Oriented Analysis: Iterative Development , Unified process & UP Phases , Inception, Elaboration , Construction Transition ,Understanding requirements , UP Disciplines ,Agile UP, Dynamic Modelling, Functional modelling, Structure analysis vs. Object oriented analysis

UNIT-V		8

Object Oriented Testing :Overview of Testing and object oriented Testing, Types of Testing , Object oriented Testing strategies ,Test case design for OO software , Inter class test case design, Software Quality Assurance,

Quality factors, Object oriented metrics: Project metric, Process Metric, Product metrics

Course outcome: After completion of this course students will be able to

CO1	Demonstrate the ability to apply the knowledge of object oriented concepts for solving system modeling and design problems.	K3
CO2	Design and implement object oriented models using UML appropriate notations. And apply the concept of domain and application analysis for designing UML Diagrams.	K3,K6
CO3	Apply the concepts of object oriented methodologies to design cleaner softwares from the problem statement.	K3
CO4	use an object-oriented method for analysis and to know techniques aimed to achieve the objective and expected results of a systems development process	K3
CO5	Demonstrate various issues for object oriented testing. And Distinguish characteristics of structural testing methods.	K3

Text books

1. James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI 2nd Edition

2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education 2nd Edition

3. Object Oriented Software Engineering by Ivar Jacobson :A use case Driven approach [By: Jacobson, Ivar] 2013 Edition

Reference Books

1.Software Engineering by Pressman

2.Applying UML and Patterns by Craig Larman

3. Object Oriented Software Engineering: Using Uml. Patterns Abd Java 3/E (Pb)

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=qiyMyyYqZVY
Unit 2	http://www.infocobuild.com/education/audio-video-courses/computer-science/ObjectOrientedAnalysis-IIT-Kharagpur/lecture-51.html
Unit 3	https://www.youtube.com/watch?v=p3H-53kzMuA
Unit 4	http://www.infocobuild.com/education/audio-video-courses/computer-science/ObjectOrientedAnalysis-IIT-Kharagpur/lecture-38.html
Unit 5	https://nptel.ac.in/courses/106/101/106101163/

Course Code	AMTCSE0201	L T P	Credit
Course Title	High Performance Computing	3 0 0	3

Course objective:

1	To introduce the concepts of Modern Processors.
2	To introduce Optimization techniques for serial code.
3	To introduce Parallel Computing Paradigms.
4	To introduce Parallel Programming using OpenMP and MPI

Pre-requisites: Computer Organization and Architecture

Course Contents / Syllabus		
UNIT-I	**Introduction:** Computational Science and Engineering: Computational Science and E engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multiscale, multi-disipline applications)	08
UNIT-II	**High-End Computer Systems:** Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built	08
UNIT-III	**Parallel Algorithms:** Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques	08
UNIT-IV	**Parallel Programming:** Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)	08
UNIT-V	**Achieving Performance:** Measuring performance, identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks	08

Course outcome: After completion of this course students will be able to		
CO 1	Implement high performance versions of standard single threaded algorithms	K3
CO 2	Demonstrate the architectural features in the GPU and MIC hardware accelerators.	K2
CO 3	Formulate programs to extract maximum performance in a multicore, shared memory execution environment processor	K3
CO 4	Understand and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.	K_2
CO 5	Student will be able to understand architecture of computing technology.	K2

Text books:

1. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for
2. Scientists and Engineers, Chapman & Hall / CRC Computational Science series, 2011.
3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.
4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

Reference Books:

1. Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998.
2. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984.
3. Parallel Computing: Theory and Practice by Michael J. Quinn

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://youtu.be/11Z_RRFe6Rg
Unit 2	https://youtu.be/gZpUcsB9TFc
Unit 3	https://youtu.be/FVn2PZVOZ7Q
Unit 4	https://youtu.be/a8R784VtXBg
Unit 5	https://youtu.be/asIgUJfOCws

M. TECH FIRST YEAR			

Course Code	AMTCSE0202	**L T P**	**Credit**
Course Title	**Robotic Process Automation**	**3 0 0**	**3**

Course objectives:

The objective of this course is to familiarize students with Robotic Process Automation (RPA), the tools, installation, Robot Development, Controls room and BOT deployment. It aims to make them understand and learn about various bots and its features.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 hours**

RPA Concepts: History of Automation, Software Applications and their Types, What is Programming, Data & Data Structures, Algorithms, Software Development Guidelines, Information Sharing Mechanism, Variable and Arguments, Files and File Types, Access Control Types of Bots.

Advanced: Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem

UNIT-II	**Basics of Automation Anywhere**	**8 hours**

What is Automation Anywhere, Automation Anywhere benefits, Set up of Automation Anywhere, Automation Anywhere products, What are Bots? Automation Anywhere architecture, Types of Bots, Automation Anywhere Client Features

UNIT-III	**Automation Anywhere Client Variables and Commands**	**8 hours**

Recorders, Types of variables, Commonly Used Commands, Internet Command, Application Commands, System Commands

Advanced Features:-Integration Command, Security, Image Recognition, Error Handling, FTP/SFTP, XML Automation, Object Cloning

UNIT-IV	**Meta Bots and IQ Bots**	**8 hours**

Meta Bots:-MetaBots and its Usage, MetaBot Designer, Creation of MetaBots, Record Logic in MetaBot, Configuration in MetaBots screen, Calibrations in MetaBots screen, Recording in MetaBot, Import and Export Dataset command

IQ Bots:- Introduction to IQ Bots, Install IQ Bots, Designer IQ Bots, Creation Design IQ Bots, Validations Scheduling IQ Bots

UNIT-V	**Enterprise Web Control Room**	**8 hours**

Web Control Room, Overview Benefits of Control Room, Control Room administrator, Role based accessibility , Audit Logs, Workflow Designer

Features:-Dashboard, Activity, Bots Devices, Workload

Course outcomes: **After completion of this course students will be able to**

CO 1	Understand the basics of robot RPA concepts and challenges with RPA.	K2
CO 2	Discuss different types of bots and Automation anywhere features	K2
CO 3	Understand and apply customized variables and commands in task designing	K2,K3
CO 4	Analyze and implement Meta Bots and IQ Bots.	K3,K4

CO 5	Use Enterprise Web Control Room	K3

Text books

1. Kelly Wibbenmeyer, The Simple Implementation Guide to Robotic Process Automation (RPA),2018, First Edition, iUniverse Press.

2. Vaibhav Jain, Crisper Learning: For Uipath, Latest Edition,2018,Independently Published.

3. Alok Mani Tripathi,Learning Robotic Process Automation, Latest Edition, 2018, First Edition, Packt Publishing ltd Birmingham.

NPTEL/ Youtube/ Faculty Video Link:

https://university.automationanywhere.com/community/academic-alliance/

https://university.automationanywhere.com/training/rpa-learning-trails/bot-developer-expert-v11/

M. TECH FIRST YEAR			
Course Code	**AMTCSE0251**	**LT P**	**Credit**
Course Title	**High Performance Computing Lab**	**0 0 4**	**2**
Suggested list of Experiment			

Sr. No.	Name of Experiment	CO
1.	Implement Threading rand_r: thread-safe version of rand() – randp is assigned a number from 0 and RAND_MAX – returns 0 on success	CO1
2.	Implement threading drand48() vs erand48() "return non-negative, double-precision, floating-point values, uniformly distributed over the interval [0.0 , 1.0]"	CO1
3.	Implement Pipelines, memory, low level parallelization.	CO2
4.	Write a program that passes all arguments to procedures by value, except arrays, which are passed by address.	CO2
5.	Write an algorithm and program to perform matrix multiplication of two n * n matrices on the 2-D mesh SIMD model, Hypercube SIMD Model or multiprocessor system.	CO3
6.	Study of Scalability for Single board Multi-board, multi-core, multiprocessor using Simulator.	CO3
7.	Implement Learning algorithms for Linear Feature Extraction	CO4
8.	Write a program to apply of the back-propagation algorithm	CO4
9.	Write a program to implement PCA.	CO4
10.	Study of Stochastic Model of Diffusion	CO4

Lab Course Outcome: On completion of the course, student will be able to–		
CO 1	Understand practical approach of multi-threading.	K2
CO 2	Apply operation of various functions pipelining	K3
CO 3	Apply varies options in Microprocessor	K3
CO 4	Implement learning algorithms of machine learning and diffusion.	K3

M. TECH FIRST YEAR				
Course Code	**AMTCSE0252**		**L T P**	**Credit**
Course Title	**Robotic Process Automation Lab**		**0 0 4**	**2**
Suggested list of Experiments				
Sr. No.	**Name of Experiment**			**CO**

1.	Number series
	    1.1 Natural number series
	    1.2 Odd number series
	    1.3 Even number series
	    1.4 Prime number series
	    1.5 Number order sorting
				CO1

2.	Variable swapping
	    2.1 Using three bucket method
	    2.2 Using two variables only
				CO1

3.	Print "Hello"
	    3.1 Print "Hello" by using Sequence activity
	    3.2 Print "Hello" by using Flowchart activity
				CO1

4.	Addition of two numbers			CO1
5.	Displaying a Sun Sign			CO2
6.	Guessing game			CO2
7.	Compare two columns of a spreadsheet			CO2
8.	Disk cleanup			CO2
9.	Extracting data from a website			CO2
10.	Filling a webform from an excel sheet			CO3
11.	Extracting data from an invoice image			CO3
12.	Filling a webform from a true PDF file			CO3
13.	Creating list of unique words			CO3
14.	Extracting and storing the subject of emails			CO4
15.	Implement meta bot with example			CO4
16.	Implement IQbot with example			CO4
Lab Course Outcomes: After completion of this course students will be able to				
CO 1	Understand practical approach of RPA			K2
CO 2	Apply operation of various functions on software			K3
CO 3	Understand and apply various options in enterprise control room			K2,K3
CO 4	Implement meta bot and IQ bot			K3

M. TECH FIRST YEAR			
Course Code	**AMTAI0211**	**L T P**	**Credit**
Course Title	**Computer Vision**	**3 0 0**	**3**

Course objectives:

The course covers the basic understanding of key features of Computer Vision and apply the Computer Vision concepts to Biometrics, Medical diagnosis, document processing, mining of visual content, surveillance and advanced rendering.

Pre-requisites: To extract the maximum from the course, the following prerequisites are must.
- Working knowledge of Linear Algebra, Probability Theory.
- Analysis, some notions of Signal Processing, and Numerical Optimization

Course Contents / Syllabus

UNIT-I	**Introduction to Computer Vision**	**8 hours**

Overview and State-of-the-art, The Four Rs of Computer Vision, Geometry of Image Formation, Digital Image Formation and low-level processing, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing, Two View Geometry, Planar Scenes and Homography, Interest Point Detection.

UNIT-II	**Depth estimation and Multi-camera views**	**8 hours**

Depth estimation and Multi-camera views: Robust Correspondence Estimation, Perspective, Edge Detection, Binocular Stereopsis: Camera and Epipolar Geometry; Image Filtering Rectification, DLT, RANSAC, Hough Transform, 3-D reconstruction framework; Auto calibration. Apparel, Feature Extraction, Edges - Canny, LOG, DOG.Spatiallydependenttransformations, templates and convolution, window operations, directional smoothing, othersmoothing techniques. Segmentation and Edge detection, region operations, Basic edgedetection, second order detection, crack edge detection, edge following, gradient operators,compass& Laplace operators.

UNIT-III	**Line detectors (Hough Transform) Corners**	**8 hours**

Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis-Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Morphological and other area operations, basic morphological operations, opening and closing operations, area operations, morphological transformations.

Image compression: Types and requirements, statistical compression, spatial compression,contour coding, quantizing compression.

UNIT-IV	**Recognition**	**8 hours**

Building blocks, Detectors and Descriptors, SIFT & Single Object Recognition, Optical Flow &Tracking, Introduction to Object Recognition and Bag-of-Words Models, Constellation model, Recognition: Objects, Scenes, Activities, Object classification and detection: a part-based discriminative model (Latent SVM), Objects in Scenes. Representation and Description, Object Recognition, 3-D vision and Geometry, Digital Watermarking. Texture Analysis.

UNIT-V	**Application of Light at Surfaces**	**8 hours**

PhongModel, Reflectance Map, Albedo estimation, Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges, Face Detection, Deep Learning, Image Segmentation, Feature Tracking & Motion Layers.

Case Study: Computer Vision based Mouse, Computer Vision based Text Scanner, Computer Vision based Smart Selfie, Surveillance Robot,Sixth Sense Robot

Course outcomes: After completion of this course students will be able to		
CO 1	Understand the deep architectures used for solving various Vision and Pattern Association tasks.	K1
CO 2	Analyze the appropriate learning rules for each of the architectures of perceptron and learn about different factors of back propagation.	K4
CO 3	Apply training algorithm for pattern association with the help of memory network.	K3
CO 4	Implement the models of deep learning with the help of use cases.	K3
CO 5	Understand different theories of deep learning using neural networks.	K2

Text books

1. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2nd ed, 2015, 2nd Edition.

2. Prince Simon JD, Computer vision: models, learning, and inference, 2012, 1st Edition Cambridge University Press

Reference Books

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010, springer

2. Trucco and Alessandro Verri, Introductory Techniques for 3D Computer Vision,1998, Pearson

NPTEL/ Youtube/ Faculty Video Link:

https://nptel.ac.in/courses/106/105/106105216/

https://nptel.ac.in/courses/106/106/106106224/

https://nptel.ac.in/courses/106/106/106106224/

M. TECH FIRST YEAR				

Course Code	AMTAI0212	L T P	Credits
Course Title	Neural Network	3 0 0	3

Course objectives:

The aim of the course is to learn about the building blocks used in Neural Networks and fundamentals of designing of Artificial neural network. The course covers the study of various training algorithms for pattern association and memory networks.

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Artificial Neural Network, Application of ANN, Biological Neural Network, Difference between ANN and BNN, Evolution of Neural Networks, Basic models of ANN, Activation Function, McCulloch – Pitts Neurons, Linear Separability, Hebb Networks.

UNIT-II	Supervised Learning Network	8 hours

Introduction to Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Back Propagation Networks, Radial Basis Function Network, Time Delay Neural Network, Function Link Network, Tree Neural Networks, Wavelet Neural Networks.

UNIT-III	Associated Memory Networks	8 hours

Training Algorithms for Pattern Association, Auto associative Memory Network, Heteroassociative Memory Networks, Bidirectional Associative Memory, Hopfield Networks, Iterative Auto associative Memory Networks, Temporal Associative Memory Networks.

UNIT-IV	Unsupervised Learning Networks	8 hours

Fixed Weight Competitive Nets, Kohonen Self Organizing Feature Maps, Learning Vector Quantization, Full Counterpropagatation Net, Forward only Counterpropagation Net, Adaptive Resonance Theory,

UNIT-V	Special Networks	8 hours

Simulated Annealing Network, Boltzmann Machine, Gaussian Machine, Cauchy Machine, Probabilistic Neural Net, Cascade Correlation Network, Cognitron Network, Neocognitron Network, Cellular Neural Network, Logicon Projection Network Model, Spatio Temporal Connectionist Neural Network, Optical Neural Networks.

Course outcomes: After completion of this course students will be able to

CO 1	Understand the concept of Artificial Neural Networks	K2
CO 2	Understand appropriate learning rules for each of the architectures of perceptron and learn about different factors of back propagation.	K1, K2
CO 3	Apply training algorithm for pattern association with the help of memory network.	K3
CO 4	Understand and analyze unsupervised learning system	K1, K4
CO 5	Describe different theories of unsupervised learning using neural networks.	K2

Text books

1. Raúl Rojas, "Neural Networks: A Systematic Introduction", 1996, Springer

2. Ian Goodfellow and YoshuaBengio and Aaron Courville, "Deep Learning" MIT Press, 2016.

3. DeepaSivanandam, " Principles of Soft Computing", 2007, Wiley

Reference Books
1. Deng & Yu, "Deep Learning: Methods and Applications", 2013, Now Publishers.
2. Michael Nielsen, "Neural Networks and Deep Learning", 2015, Determination Press.

NPTEL/ Youtube/ Faculty Video Link:

1. https://nptel.ac.in/courses/117/105/117105084/
2. https://nptel.ac.in/courses/106/106/106106184/
3. https://nptel.ac.in/courses/108/105/108105103/
4. https://www.youtube.com/watch?v=DKSZHN7jftI&list=PLZoTAELRMXVPGU70ZGsckr Mdr0FteeRUi
5. https://www.youtube.com/watch?v=aPfkYu_qiF4&list=PLyqSpQzTE6M9gCgajvQbc68Hk _JKGBAYT

M. TECH FIRST YEAR

Course Code	AMTCSE0211	L T P	Credit
Course Title	Software Project &Management	3 0 0	3

Course objective:

1	To understand the fundamentals of Software Project Management
2	To define & explore various scheduling terminologies and techniques.
3	To identify the necessity of testing and assurance activities as well as explore various testing tools.
4	To introduce concept of software reviews, inspections and other software monitoring and control techniques
5	To learn about different software management tools

Pre-requisites:

Course Contents / Syllabus

UNIT-I	Introduction and Software Project Planning	8 hours

Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope Document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of Project Plan, Structure of a Software Project Management Plan, Software Project Estimation, Estimation Methods, Estimation Models, Decision Process

UNIT-II	Project Organization and Scheduling Project Elements	8 hours

Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Building the Project Schedule, Scheduling Terminology and Techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts

UNIT-III	Project Monitoring and Control	8 hours

Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming

UNIT-IV	Software Quality Assurance and Testing Objectives	8 hours

Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & Validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of Correctness, Statistical Quality Assurance, Cleanroom Process.

UNIT-V	Project Management and Project Management Tools Software Configuration Management	8 hours

Software Configuration Items and Tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and Risk Types, Risk Breakdown Structure (RBS), Risk Management Process: Risk Identification, Risk Analysis, Risk Planning, Risk Monitoring, Cost Benefit Analysis, Project Closeout, Software Project Management Tools: CASE Tools, MS-Project, Jira software, Trello and other Planning and Scheduling Tools

Course outcome: After completion of this course students will be able to

CO 1	Describe the basic terminology of Software Project Management.	K_1, K_2
CO 2	Explore project lifecycle & scheduling techniques to implement project elements successfully.	K_3, $K4$
CO 3	Review the dimensions of project monitoring and controlling	K2

		through different types of reviews.	
	CO4	Implement testing objectives, test plan and implement various types of testing, ensuring good software quality	K3
	CO 4	Defend various tools to facilitate software project management process	K4, K5

Text books

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press

Reference Books

1. S. A. Kelkar, Software Project Management, PHI Publication.

2. Harold R. Kerzner, Project Mangment "A Systems Approach to Planning, Scheduling, and Controlling" Wiley.
3. Mohapatra, Software Project Management, Cengage Learning.
4. P.K. Agarwal, SAM R., Software Project Management, Khanna Publishing House

M.TECH FIRST YEAR

Course Code	AMTCSE0212	L T P	Credit
Course Title	**Virtual and Augmented Reality**	**3 0 0**	**3**

Course objective:

1	To Create your own VR or AR idea in Unity
2	To Design for different VR and AR platforms
3	To learn Manage production of VR and AR projects
4	To effectively design applications around the benefits of VR and AR
5	To establish to Connect with a powerful network in the VR and AR industry

Pre-requisites:
Basic Knowledge of Software Engineering

Course Contents / Syllabus

UNIT-I	**Developing VR Mechanics (Part 1)**	**8 hours**

Introduction to C# and applying scripts to 3D game objects. Creating interactions with basic 3D objects.Creating custom animations, animating physics and 3D objects, 3D and 2D user interfaces, and applying 3D UI in AR.

UNIT-II	**Developing VR Mechanics**	**9 hours**

Applying grab and release mechanics. Enhancing physics-based interactions and throw mechanics. Building interactable experiences.Improving on VR interactions with the application of delegates and inheritance in C# scripting.

UNIT-III	**3D Interactions and Physics**	**9 hours**

Creating an AR app using Vuforia. Introduction to AR Foundation's core features, including spacial mapping, plane tracking and occlusion.

UNIT-IV	**Designing VR Experiences**	**6 hours**

Virtual controls like buttons, levers, dials, sliders. Interacting & manipulating objects using raycasting.AR VR for Medical trainings and healthcare

UNIT-V	**Optimizing and Publishing Your App**	**8 hours**

Introduction to Unity Collaborate. Optimizing your VR or AR experience. Publishing your project to the App Store.Case Study of vuforia AR/VR Projects.

Course outcome: After completion of this course students will be able to

CO 1	Create your own VR or AR idea in Unity	K_1,K2, K6
CO 2	Design for different VR and AR platforms	K_1, K2,K_6
CO 3	Implement production of VR and AR projects	K3
CO 4	Apply applications around the benefits of VR and AR	K3
CO 5	Demonstrate to a powerful network in the VR and AR industry	K_3

Text books

1. William Gibson, Neuromancer- Case was the sharpest data-thief in the matrix — until he

crossed the wrong, 1984
2. Orson Scott Card, Ender's Game- Once again, Earth is under attack. An alien species is poised for a final, 1985
3. Neal Stephenson, Snow Crash- In reality, Hiro Protagonist delivers pizza for Uncle Enzo's CosoNostra Pizza, 1992
Reference Books
1. M.T. Anderson, Feed- For Titus and his friends, it started out like any ordinary, 2002
Youtube Video Links
https://www.youtube.com/watch?v=w0LQh0vCeqI   https://www.youtube.com/watch?v=Ln_LP7c23WM   https://www.youtube.com/watch?v=OT2O7uNldQk&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=6
https://www.youtube.com/watch?v=ul6nW1g3xK0&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=16   https://www.youtube.com/watch?v=PR_ZwLfjWrA&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=17
https://www.youtube.com/watch?v=5q_KBeNlRFk&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&index=19

M. TECH FIRST YEAR

Course Code	AMTCY0211	L T P	Credit
Course Title	**Cyber Crime, Cyber Laws & Cyber Forensics**	**3 0 0**	**3**

Course objective:

1	This course will look at the emerging legal, policy and regulatory issues pertaining to cyberspace and cybercrimes.
2	To cover all the topics from fundamental knowledge of Information Technology and Computer Architecture so that the participant can use to understand various aspects of working of a computer.
3	To identify the emerging Cyberlaws, Cybercrime & Cyber security trends and jurisprudence impacting cyberspace in today's scenario.
4	To provide vivid knowledge about different types of Digital Forensics such as Mobile Device Forensics, Network Forensics, Cloud based Forensics etc., including the Standard Operating Procedures for IO's which will be useful in investigating real-time cases pertaining to cybercrime.

Pre-requisites:

Course Contents / Syllabus

UNIT-I	**Cyber Crime**	**8 Hours**

Introduction – History and Development – Definition, Nature and Extent of Cyber Crimes in India and other countries - Classification of Cyber Crimes – Trends in Cyber Crimes across the world.

UNIT-II	**Forms of Cyber Crimes,Frauds**	**8 Hours**

Hacking, cracking, DoS – viruses, works, bombs, logical bombs, time bombs, email bombing, data diddling, salami attacks, phishing, steganography, cyber stalking, spoofing, pornography, defamation, computer vandalism, cyber terrorism, cyber warfare, crimes in social media, malwares, adware, scareware, ransomware, social engineering, credit card frauds & financial frauds, telecom frauds. Cloud based crimes - understanding fraudulent behaviour, fraud triangle, fraud detection techniques, Intellectual Property Rights and Violation of Intellectual Property rights, Ecommerce Frauds and other forms.

UNIT-III	**Fundamentals of Cyber Law**	**8 Hours**

Introduction on cyber space, Jurisprudence of Cyber Law, Scope of Cyber Law, Cyber law in India with special reference to Information Technology Act, 2000 (as amended) and Information Technology Act, 2008.

UNIT-IV	**Windows Forensics**	**8 Hours**

Volatile Data Collection: -Memory Dump, System Time, Logged On Users, Open Files, Network Information (Cached NetBIOS Name Table), Network Connections, Process Information, Process-to-Port Mapping, Process Memory, Network Status, Clipboard Contents, Service / Driver Information, Command History, Mapped Drives, Shares
Non-Volatile Data Collection:-Disk Imaging (External Storage such as USB and Native Hard Disk), Registry Dump, Event Logs, Devices and Other Information, Files Extraction, Write-Blocking port
Registry Analysis, Browser Usage, Hibernation File Analysis, Crash Dump Analysis, File System Analysis, File Metadata and Timestamp Analysis, Event Viewer Log Analysis, Timeline Creation, Evidence Collection in Linux and Mac Operating system.

UNIT-V	**Network Forensics**	**8 Hours**

Understanding Protocols with Wireshark: -TCP, UDP, HTTP(S), SSH, Telnet, SMTP, POP / POP3, IMAP, FTP, SFTP, ARPPacket Capture using Wireshark, tshark and tcpdump, Packet Filtering, Extraction of Data from PCAP file, Netflow vs Wireshark, Analysis of logs: - CISCO logs, Apache Logs, IIS Logs, Other System Logs.

Course outcome:	After completion of this course students will be able to	
CO 1	Understand the Cyber Crimes in India and trends in world	K2
CO 2	Classify different Frauds like hacking, phishing, credit card	K2
CO 3	Explain the details of Cyber law in India with Information Technology Act, 2000 & 2008	K2
CO 4	Understand the windows Forensics in reference of volatile and non-volatile data collection	K2
CO 5	Understand the network Forensics with the help of different protocols used in networking	K2

Text books

1. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
2. Bill Nelson, Amelia Phillips and Christopher Steuart; "Guide to Computer Forensics and Investigations" – 3 rd Edition, Cengage, 2010 BBS.
3. Vikas Vashishth.; "Law and practice of intellectual property in India"

Reference Books

1. Vakul Sharma; "Information Technology: Law and Practice", Universal Law Publishing Co., India, 2011.
2. K. Kent, S. Chevalier, T. Grance and H. Dang; "Guide to Integrating Forensic Techniques into Incident Response", Special Publication 800-86, NIST, Gaithersburg, Maryland, 2006.
3. Sherri Davidoff and Jonathan Ham; "Network Forensics – Tracking Hackers through Cyberspace", Pearson Publications, 2012.

M. TECH FIRST YEAR

Course Code	AMTCY0212	L T P	Credit
Course Title	**Data Science for Security Analysis**	**3 0 0**	**3**

Course objective:

1	To develop fundamental knowledge of concepts underlying data science projects.
2	To explain how math and information sciences can contribute to building better algorithms and software.
3	To develop applied experience with data science software, programming, applications
4	To give a hands-on experience with real-world data analysis.

Pre-requisites:Students are expected to have basic knowledge of algorithms and reasonable programming experienceand some familiaritywith basic linear algebra

Course Contents / Syllabus

UNIT-I	**Introduction:**	**8**

Introduction: What is Data Science?, Big Data and Data Science hype, Datafication, Current landscape of perspectives, Exploratory data analysis

UNIT-II	**Introduction to Machine Learning:**	**8**

Basic Machine Learning Algorithms,Linear Regression, k-Nearest Neighbors (k-NN),k-means,Association Rules, Regression and Classification.
Introduction to R

UNIT-III	**Data Visualization**	**8**

Basic principles, ideas and tools for data visualization,Data Collection and Data Blending, Data Wrangling: APIs and other tools for scrapping the Web, Statistical modeling, probability distributions, fitting a model,

UNIT-IV	**Big Data Analytics**	**8**

Relational databases, SQL , Big data storage and retrieval: noSQL,GraphDB, Big data distributed computing: mapreduce, spark rdd,neural networks and deep learning

UNIT-V	**Data Science and Ethical Issues:**	**8**

Privacy, security, ethical issue in data science-Unfair Discrimination, Transparency, Avoiding Bias, Mitigating Malicious Attacks, Data sharing Feature engineering and selection, Text mining and information retrieval, Network Analysis, Mining Social-Network Graphs - Social networks as graphs- Clustering of graphs- Direct discovery of communities in graphs- Partitioning of graphs- Neighborhood properties in graphs

Course outcome: **After completion of this course students will be able to**

CO 1	Understand basic notions and definitions in data analysis, machine learning.	K3
CO 2	Understand and Apply standard methods of data analysis and information retrieval	K2,K3
CO 3	Apply to develop complex analytical reasoning.	K3
CO 4	Analyse translate a real-world problem into mathematical terms	K4

Text books

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline.O'Reilly. 2014.

2. Jure Leskovek, Anand Rajaraman and Jerey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press. 2014.

3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013

Reference Books (Atleast 3)

1. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009.
2. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. 2014.
3. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://youtu.be/-ETQ97mXXF0
Unit 2	https://youtu.be/taznbPP3YMU
Unit 3	https://youtu.be/SUXOFrhWsAQ
Unit 4	https://youtu.be/fn1rKKNLuzk
Unit 5	https://youtu.be/PMQPSnnuvNM

M. TECH FIRST YEAR			

Course Code	AMTAI0213	L T P	Credit
Course Title	Reinforcement Learning	3 0 0	3

Course objectives:

The course aims to cover to build a Reinforcement Learning system for decision making problems and learn the space of RL algorithms like Temporal- Difference learning, Monte Carlo, Sarsa, Q-learning, Policy Gradients, Dyna.

Course Contents / Syllabus		

UNIT-I	Introduction to RL	8 hours

Introduction to Reinforcement Learning (RL), Origin and history of RL research, RL and its connections with other ML branches. Linear algebra overview, Probability overview, Sequential Decision Making, Components of a reinforcement learning agent, Taxonomy of reinforcement learning agents. Introduction to Instance based learning.

UNIT-II	Markov Decision Processes and Bandit Algorithms	8 hours

Policy Gradient Methods & Introduction to Full RL, Reinforcement Learning Problems: MDP Formulation, Bellman Equations & Optimality Proofs, Markov Processes, Markov Reward Processes, Markov Decision Processes, Bandit Algorithms (UCB, PAC, Median Elimination, Policy Gradient), Contextual Bandits.

UNIT-III	Dynamic Programming:	8 hours

Temporal Difference Methods, DQN, Fitted Q & Policy Gradient Approaches, Introduction to Dynamic Programming, Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Hierarchical Reinforcement Learning, Value Iteration, Generalized Policy Iteration, Hierarchical RL: MAXQ, Asynchronous Dynamic Programming, Efficiency of Dynamic Programming, Temporal Difference Prediction, Why TD Prediction Methods, On-Policy and Off-Policy Learning, Q-learning, Reinforcement Learning in Continuous Spaces, SARSA.

UNIT-IV	Value Function:	8 hours

Bellman Equation, Value Iteration, and Policy Gradient Methods, Value Function, Bellman Equations, Optimal Value Functions, Bellman Optimality Equation,
Optimality and approximation, Value Iteration.

UNIT-V	Introduction to Policy-based Reinforcement Learning:	8 hours

Policy Gradient, Monte Carlo Policy Gradients, Generalized Advantage Estimation (GAE), Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Incremental Implementation, Policy optimization methods (Trust Region Policy Optimization (TRPO) and Proximal Policy, Optimization (PPO).

Course outcomes: After completion of this course students will be able to

CO 1	Describe key features of Reinforcement Learning (RL).	K2
CO 2	Decide, formulate, design, and implement given application as RL problem.	K6
CO 3	Implement common RL algorithms and evaluate using relevant metrics.	K3
CO 4	Evaluate the value function & various equations.	K5
CO 5	Discuss the various policy based on Reinforcement Learning.	K2

Text books

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, 2nd Edition, 2017, MIT Press. ISBN: 9780262039246.

2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective,2012, MIT Press, ISBN: 9780262018029.
3. Alexander Zai , Brandon Brown, Deep Reinforcement Learning in Action, 2020, 1st Edition, Manning Publications,

Reference books

1. Mohit Sewak, Deep Reinforcement learning: Frontiers of Artificial Intelligence, 2019, Springer.

2. Sugiyama, Masashi, Statistical reinforcement learning: modern machine learning, 2015, chapman and Hall

NPTEL/ Youtube/ Faculty Video Link:

1. https://nptel.ac.in/courses/106/106/106106143/
2. https://nptel.ac.in/courses/111/107/111107137/
3. https://nptel.ac.in/courses/127/101/106101224/
4. https://nptel.ac.in/courses/127/101/127101012/

M. TECH FIRST YEAR			

Course Code	**AMTAI0214**	**L T P**	**Credit**
Course Title	**Introduction to Blockchain**	**3 0 0**	**3**

Course objective:

The objective of this course is to provide conceptual understanding of how block chain technologycan be used to innovate and improve business processes. The course covers the technologicalunderpinning of block Chain operations in both theoretical and practical implementation ofsolutions using block Chain technology.

Pre-requisites: Cryptography Techniques, Data Structures and Algorithms, Introduction to Programming

Course Contents / Syllabus		
UNIT-I	**Introduction to Blockchain**	**8 HOURS**

Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

UNIT-II	**Basic crypto primitives**	**8 HOURS**

Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key cryptography, verifiable random functions, Zero-knowledge systems.

UNIT-III	**Distributed Consensus, Consensus in Bitcoin**	**8 HOURS**

The basics, Proof of Work (PoW), Proof of Stake (PoS), PoW vs PoS and Beyond, Miners in blockchain, Permissioned Blockchain (Basics, Consensus), Permissioned Blockchain (RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance). Bitcoin scripts.

UNIT-IV	**Blockchain Architectures**	**8 HOURS**

Public, Private, Hybrid, Blockchain for Enterprise – Overview, Blockchain Components and Concepts, Ethereum

UNIT-V	**Smart Contracts**	**8 HOURS**

Turing completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts.

Course outcome:	**After completion of this course students will be able to**	
CO 1	List fundamentals of block chain and explain cryptographic concepts underlying block chain technology in layman terminology.	K1
CO 2	Describe how cryptography applies to block chain and impacts implementation-related decisions.	K2
CO 3	Apply block chain technology, how it relates to the myriad of associated technologies and concepts (communication, consensus, architecture, identity, among others).	K3
CO 4	Create a minimalist block chain application.	K6
CO 5	Illustrate Smart Contract Languages and comparison of Smart Contracts with Bitcoin scripting.	K4

Text books

1. Bettina Warburg, Bill Wanger, Tom Serres, "Basics of Blockchain" 2019,Independently published, (ISBN-13: 978-1089919445).
2. Melanie Swan, "Block Chain: Blueprint for a New Economy", 2015, O'Reilly.
3. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming"

Reference Books

1. Antonopoulos, Andreas M. "Mastering Bitcoin: unlocking digital cryptocurrencies." 2014, O'Reilly Media, Inc.
2. Joseph J. Bambara "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, 1st Edition 2018, Mcgraw hill

M. TECH FIRST YEAR

Course Code	AMTCSE0213	L T P	Credit
Course Title	**Digital Image Processing**	**3 0 0**	**3**

Course objective:

1	To introduce the student to image processing fundamentals and correlation and convolution technique.
2	To describe the image enhancement techniques.
3	To describe various Image transformation technique.
4	To describe the morphological image processing and segmentation Techniques.
5	To describe Image compression Technique.

Pre-requisites: Linear algebra, Matrices, Matrix Operations, Determinants, Systems of Linear Equations, Eigen values, Eigenvectors, Statistics and probability, Programming experience, preferably in Matlab

Course Contents / Syllabus

UNIT-I	**Introduction:** Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, Image file formats Relationship between pixels, distance functions, scanner, Image Analysis, Intensity transformations, contrast stretching, Correlation and convolution	**8**
UNIT-II	**Statistical and spatial operations:** Grey level transformations, histogram equalization, histogram specification, smoothing & sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration. Inverse and weiner filtering. FIR weiner filter, Filtering using image transforms, smoothing splines and interpolation.	**8**
UNIT-III	**Image Transforms** - Fourier, DFT, DCT, DST, Haar, Hotelling, Karhunen - Loeve, Singular value decomposition**,** Walsh, Hadamard, Slant. Representation and Description - Chain codes, Polygonal approximation, Signatures Boundary Segments, Skeltons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, PCA.	**8**
UNIT-IV	**Morphological and other area operations:** basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images. Segmentation and Edge detection region operations, basic edge detection, second order detection, crack edge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, Otsu's method, region based segmentation, segmentation by morphological watersheds. Use of motion in segmentation	**8**
UNIT-V	**Image compression: T**ypes and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudo color image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards	**8**

Course outcome: **After completion of this course students will be able to**

CO 1	Understand The fundamentals of images and its processing	K1,K2

CO 2	Apply the concepts of Image enhancementand image Restoration Algorithms/techniques	K2,K3
CO 3	Apply the various image transformation Algorithms/techniques	K2,K3
CO 4	Understand and apply morphological image processing and image Segmentation Algorithms/technique	K2,K3
CO 5	Understand the concepts of image (gray and color) compression technique	K2

Text books

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition, 2010

2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002

3. Digital Image processing, S Jayaraman, TMH, 2012

Reference Books

1. William K. Pratt, Digital Image Processing, 3rd Edition, John Wiley, 2001.

2. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.

4. Kenneth R. Castleman, Digital Image Processin, Pearson, 2006.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://nptel.ac.in/courses/117/105/117105079/ https://youtu.be/N0Dwh3avx9A?list=PLi7vCu7jEp8_nFoyZ-8exq5UYW_CAZ6zM https://youtu.be/MQm6ZP1F6ms
Unit 2	https://nptel.ac.in/courses/117/105/117105079/ https://youtu.be/LyDrGJRT0PI https://youtu.be/994ZNi7rSXo https://youtu.be/sjK4zrZmjak https://youtu.be/5qxrzD6ODHc https://youtu.be/rIXEO87thug
Unit 3	https://youtu.be/eVugfKb91ZY https://youtu.be/mgjSauT17hU https://youtu.be/j3_Ck5oP5oI https://youtu.be/7xKhYfPel9w https://youtu.be/vaS6rS8ZpkU https://youtu.be/CD4KyEHfVx4
Unit 4	https://youtu.be/AisfQIql0bY https://youtu.be/sckLJpjH5p8 https://youtu.be/IbHPLbng_d4
Unit 5	https://youtu.be/uTwm3Zv1HfA https://youtu.be/11b5NnpEoVE https://youtu.be/S8FkaEWfCOg

M. TECH FIRST YEAR			

Course Code	AMTCSE0214	L T P	Credit
Course Title	**Distributed Database**	3 0 0	3

Course objective:

1	To learn the principle and foundation of database and distributed database
2	To learn the architecture, design issue and integrity control of distributed database
3	To learn the details of query processing and query optimization technique.
4	To know the concept of transaction and concurrency control management in distributed database.
5	To learn the current trends technology object management and reliability protocols

Pre-requisites: Good knowledge in Database Management System

Course Contents / Syllabus		
UNIT-I	**Introduction to Database and Distributed Database**	**8**
	Introduction: Concepts and Architecture; Data Model; Normalization, Deadlock and Concurrency Control; Distributed databases concept and features, Features of Centralized databases, Architectures for DDBMS: cluster federated, parallel databases and client server architecture. Distribution Transparency and levels access primitives, integrity constraints in Distributed Database.	
UNIT-II	**DISTRIBUTED DATABASE DESIGN**	**8**
	Types of data fragmentation, Framework for Distributed Database Design, Database Fragmentation Design - horizontal fragmentation, vertical fragmentation, Allocation of Fragments, allocation problem, allocation model, Translation of Global Queries to Fragment Queries, The Equivalence Transformation for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping, Aggregate Function Evaluation, Parametric Queries, Database Integration, Schema Matching, Schema Integration, Schema Mapping.	
UNIT-III	**Query Processing and Optimization**	**8**
	Overview of Query Processing objectives, Characterization of Query Processors, Layers of Query Processing, Query Decomposition and Data Localization, Localization of Distributed Data, Optimization of Distributed Queries, Centralized Query Optimization, Distributed Query Optimization, dynamic and static approach ,multidatabase query processing	
UNIT-IV	**Distributed Transaction Management And Concurrency Control:**	**8**
	Introduction to Transaction Management, Properties of Transactions, Types of Transactions, Distributed Concurrency Control, Taxonomy of Concurrency Control Mechanisms, Locking - Based Concurrency Control Algorithms, Timestamp Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management, The System R * The Architecture of System R*, Compilation, Execution and Recompilation of Queries, Protocols for Data Definition and Authorization in R*, Distributed data dictionary management ,Distributed database administration.	
UNIT-V	**Reliability and distributed object management application technology**	**8**

| | Distributed DBMS Reliability Concepts and Measures, Failures in Distributed DBMS, Local and distributed Reliability Protocols, Data Replication Protocols. Distributed Object/component-based DBMS; Fundamental Object concepts and models, Object query processing, Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management. | |

Course outcome: **After completion of this course students will be able to**

CO 1	Describe distributed database management system understand and describe internal algorithms in detail	K2,K1
CO 2	Apply various distributed system design techniques	K3
CO 3	Understand optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.	K2,K4
CO 4	Identify and apply the advanced database techniques (e.g. in concurrency control, buffer management, and recovery, transactional management)	K1,K3
CO 5	Understand distributed object management technology and replication protocols	K2

Text books

1. Stefano Ceri; GuiseppePelagatti, Distributed Databases - Principles and Systems, Tata McGraw Hill, 1985.

2. M. TamerOzsu Patrick Valduriez, Principles of Distributed Database Systems, 2011

Reference Books

1Ozsu M.T./ Sridhar S., Principles of Distributed database systems, Pearson education, 2011.

2. M. Tamer Özsu; and Patrick Valduriez, Principles of Distributed Database Systems, Prentice Hall, 3rd edition ,2011

3. Korth&Sudarshan, Database System Concepts, 6th edition TMH, 2013

4 . Raghu RamaKrishnan, JohnaasGehrke, "Database Management Systems", Tata McGrawHill, 2000

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=Q1RIpXS7lPc&list=PLV8vIYTIdSnbAW2wj_TiHyrFJId5zkhz2https://www.youtube.com/watch?v=aoMOmSx5Zyw
Unit 2	https://www.youtube.com/watch?v=qxBelEX3pm0
Unit 3	https://www.youtube.com/watch?v=JBqpPYth8ts
Unit 4	https://www.youtube.com/watch?v=lhBo6uidRJQ
Unit 5	https://www.youtube.com/watch?v=7FMTEmyyXHY

M. TECH FIRST YEAR

Course Code	AMTCY0213	L T P	Credit
Course Title	**Cyber Forensics Tools and Technology**	**3 0 0**	**3**

Course objective:

1	Learn the security issues network layer and transport layer.
2	Be exposed to security issues of the application layer.
3	Learn computer forensics.
4	Be familiar with forensics tools.
5	Learn to analyze and validate forensics data

Pre-requisites:

Course Contents / Syllabus

UNIT-I	Digital Investigation	8 Hours

Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology –Digital Evidence in the Courtroom.

UNIT-II	Understanding information	8 Hours

Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers.

UNIT-III	Computer Basics for Digital Investigators	8 Hours

Computer Forensic Fundamentals -Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists. Handling the Digital Crime Scene -Digital Evidence Examination Guidelines –ACPO – IOCE – SWGDE -DFRWS – IACIS –HTCIA - ISO 27037

UNIT-IV	Types of Computer Forensics Tools and Technology	8 Hours

Tools and Types of Military Computer Forensics Technology -Tools and Types of Law Enforcement Computer Forensic Technology -Tools and Types of Business Computer Forensic Technology

UNIT-V	Evidence Collection and Forensics Tools	8 Hours

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

Course outcome: After completion of this course students will be able to

CO 1	Discuss the security issues network layer and transport layer.	K1,K2
CO 2	Apply security principles in the application layer.	K3
CO 3	Discuss computer forensics.	K2
CO 4	Use various forensics tools.	K3
CO 5	Analyze and validate forensics data.	K4

Text books

1.	Digital Forensics with Open Source Tools. Cory Altheide and Harlan Carvey, ISBN: 978-1-59749- 586-8, Elsevier publication, April 2011
2.	**2**Computer Forensics and Cyber Crime: An Introduction (3rd Edition) by Marjie T. Britz, 2013.

Reference Books

1.	Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
2.	Guide to Computer Forensics and Investigations (4 th edition). By B. Nelson, A. Phillips, F. Enfinger, C. Steuart. ISBN 0-619-21706-5, Thomson, 2009.
3.	Computer Forensics: Hard Disk and Operating Systems, EC Council, September 17, 2009
4.	Computer Forensics Investigation Procedures and response, EC-Council Press, 2010
5.	Digital Evidence and Computer Crime, Third Edition: Forensic Science, Computers, and the Internet by Eoghan Casey, 2011

Other Resources:

1.	Computer Forensic Training Center Online http://www.cftco.com/
2.	Computer Forensics World http://www.computerforensicsworld.com/
3.	Computer Forensic Services http://www.computer-forensic.com/
4.	Digital Forensic Magazine http://www.digitalforensicsmagazine.com/
5.	Journal of Digital Forensic Practice http://www.tandf.co.uk/15567281
6.	DOJ Computer Crime and Intellectual Property Section - http://www.usdoj.gov/criminal/cybercrime/searching.html
7.	Electronic Crime Scene Investigation: A Guide for First Responders - http://www.ojp.usdoj.gov/nij/pubs-sum/187736.htm and related publications at http://nij.ncjrs.org/publications/pubs_db.asp

M. TECH FIRST YEAR

Course Code	AMTCY0214		L T P	Credit
Course Title	Intrusion Detection System		3 0 0	3

Course objectives:

1	Familiarise students about the common threats faced in era of internet and the necessity of intrusion detection systems for securing the systems.
2	To recognize the essential concepts of intrusions and intrusion detection.
3	Be conversant with taxonomy of intrusion detection systems and understand principles and techniques used in intrusion detection.
4	To gain knowledge about the research prospective of intrusion detection systems.
5	Empower students to recognise and analyse the models for intrusion detection and implement intrusion detection systems.

Pre-requisites: Fundamental knowledge Cyber security, Networks and Operating Systems.

Course Contents / Syllabus

UNIT-I	**INTRODUCTION**: Concepts of Security, Introduction to Intrusions, Need of Intrusion Detection, Types of IDS, Taxonomy of Intrusion Detection Systems (IDSs). Attack trees and Correlation of Alerts, Autopsy of Worms and Botnets, Malware Detection, Obfuscation, Email/IM security Issues, Viruses/Spam, From signatures to thumbprints to zero day Detection, Insider Threat Issues, Masquerade and Impersonation Traitors, Decoys and Deception.	**8 hours**
UNIT-II	**HOST-BASED INTRUSION DETECTION**: Host Vulnerability and Exploits – Denial of Service (DoS) and DDoS, Gaining Unauthorized Access to Host. **NETWORK-BASED INTRUSION DETECTION**: Network Vulnerabilities and Attacks – ARP Attacks, IP Attacks, ICMP Attacks, UDP Attacks, TCP Attacks, DNS Attacks.	**10 hours**
UNIT-III	**DATABASE AND APPLICATION-SPECIFIC INTRUSION DETECTION**: Limitations of Existing Intrusion Detection Systems, Requirements of Application-Specific and Database Intrusion Detection.	**6 hours**
UNIT-IV	**ANOMALY DETECTION**: Principles of Anomaly Detection, Advantages & Limitations of Anomaly Detection, Anomaly Detection Techniques, Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities Payload Anomaly Detection	**8 hours**
UNIT-V	**CASE STUDY:** Case Study of Research in Host-Based Intrusion Detection Systems, Case Study of Research in Network-Based Intrusion Detection Systems, Case Study of Research in Application-Specific and Database IDS, Case Study in Research in Anomaly Detection Systems.Data mining tools -a case study for network intrusion	**8 hours**

Course outcome: After completion of this course students will be able to

CO 1	Understand the comprehensive knowledge on the subject intrusion detection systems in order to improve their security posture.	K2
CO 2	Analyse different intrusion detection alerts and logs to distinguish types of attack from false alarms	K4

CO 3	Discuss the principles and techniques used in intrusion detection.	K2
CO 4	Understand the way of applyingIntrusion Detection tools and techniques, as well as the challenges and limitations of intrusion detection systems	K2
CO 5	Discuss various case studies on research outlook in intrusion detection systems.	K2

Text books

"Intrusion Detection Systems" by Robert Barnard

"Intrusion Detection with Snort" by Jack Koziol

"Intrusion Detection Systems (Advances in Information Security)" by Roberto Di Pietro and Luigi V Mancini

Reference Books

Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.

Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007

Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=RYB4cG8G2xo
Unit 2	https://www.youtube.com/watch?v=2YGUvopGkQc

M. TECH FIRST YEAR

Course Code	AMTAI0215		L T P	Credit
Course Title	Natural Language Processing		3 0 0	3

Course objectives:

This course provides an introduction to the field of Natural Language Processing (NLP). The course introduces both linguistic (knowledge-based) and statistical approaches to NLP, illustrate the use of NLP techniques and tools in a variety of application areas, as well as provide insight into many open research problems.

Pre-requisites: None

Course Contents / Syllabus

UNIT-I	Introduction to Natural Language Understanding	8 hours

The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

UNIT-II	Word Level and Syntactic Analysis	8hours

Unigram, Bigram language models, generating queries from documents, Language models and smoothing, ranking with language models, KullbackLeiblerdivergence, Divergence from randomness, Passage retrieval and ranking. Management of Information Retrieval Systems: Knowledge management, Information management, Digital asset management, Network management, Search engine optimization, Records compliance and risk management, Version control, Data and data quality, Information system failure.

UNIT-III	Semantic Analysis	8hours

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Back off – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in POS tagging –Maximum Entropy models, popular tools and technologies.

UNIT-IV	Grammars for Natural Language	8hours

Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

UNIT-V	Ambiguity Resolution	8hours

Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Course outcomes :After completion of this course students will be able to

CO 1	Understand linguistic phenomena with formal grammars	K2
CO 2	Analyze NLP algorithms	K4
CO 3	Understand Morphology, syntax, semantics, and pragmatics of the language.	K2
CO 4	Comprehend the concepts of WorldNet, Semantic Roles and Word Sense Disambiguation	K2

| CO 5 | Apply NLP techniques to design real world NLP applications | K3 |

Text books

1. Akshar Bharti, VineetChaitanya and Rajeev Sangal, NLP: A Paninian Perspective,1st edition1995, Prentice ISSBN 9788120309210

2. James Allen, Natural Language Understanding, 2nd edition, 1995 Pearson Education ISBN 13: 9780805303346

Reference Books

1. D. Jurafsky, J. H. Martin, Speech and Language Processing, 2nd edition, Pearson Education 2009ISBN-10: 1292025433

2. T. Winograd, Language as a Cognitive Process, 1st edition, 1983 Addison-Wesley ISBN 020108-571-2

3. L.M. Ivansca, S. C. Shapiro, Natural Language Processing and Knowledge Representation, 2nd edition, 2000 AAAI Press ISBN-13 : 978-0262590211

NPTEL/ Youtube/ Faculty Video Link:

https://nptel.ac.in/courses/106/101/106101007/

https://nptel.ac.in/courses/109/106/109106083/

https://nptel.ac.in/courses/106/105/106105158/

https://nptel.ac.in/courses/106/106/106106211/

https://nptel.ac.in/courses/106/101/106101007/

M. TECH FIRST YEAR

Course Code	AMTAI0216	L T P	Credit
Course Title	Deep Learning	3 0 0	3

Course objectives:

The course covers the Deep Learning algorithms, implementation and their limitations. The course aims to make students understand the various applications of Deep Learning and apply in real-world data.

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Introduction to TensorFlow: Computational Graph, Key highlights, Creating a Graph, Regression example, Gradient Descent, TensorBoard, Modularity, Sharing Variables, Keras, Perceptrons: What is a Perceptron, XOR Gate example.

UNIT-II	Neural Networks	8 hours

Activation Functions : Sigmoid, ReLU, Hyperbolic Fns, Softmax, Artificial Neural Networks: Introduction, Perceptron Training Rule, Gradient Descent Rule.

UNIT-III	Backpropagation Algorithms	8 hours

Gradient Descent and Backpropagation: Gradient Descent, Stochastic Gradient Descent, Backpropagation, Some problems in ANN, Optimization and Regularization :Overfitting and Capacity, Cross Validation, Feature, Selection, Regularization, Hyperparameters .

UNIT-IV	Convolutional Neural Networks	8 hours

Introduction to CNNs, Kernel filter, principles behind CNNs, Multiple Filters, CNN applications, Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications.

UNIT-V	Deep Learning applications	8 hours

Data-Centric applications, Image Processing, Natural Language Processing, Speech Recognition, Video Analytics, Case studies

Course outcomes: After completion of this course students will be able to

CO 1	Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline	K2
CO 2	Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.	K2, K3
CO 3	Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces	K1
CO 4	Understand the language and fundamental concepts of artificial neural networks.	K2
CO 5	Build own deep learning project	K2

Text Books

1.Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, 2016, MIT Press.

2.François Chollet, Deep Learning with Python, 2017, 1st edition, Manning Publications.

3.SudharsanRavichandiran, Hands-On Deep Learning Algorithms with Python: Master deep learning algorithms with extensive math by implementing them using TensorFlow, 2019, 1st Edition,Packt Publishing.

Reference Books
1. Deng & Yu, Deep Learning: Methods and Applications, 2013, Now Publishers.
2. Michael Nielsen, Neural Networks and Deep Learning, 2015, Determination Press.
3. AurelienGeron, Hands–On Machine Learning with Scikit–Learn and TensorFlow 2e: Concepts, Tools, and Techniques to Build Intelligent Systems, Paperback – Illustrated, 2019, 2nd New edition, O′Reilly.
NPTEL/ Youtube/ Faculty Video Link: 1. https://nptel.ac.in/courses/117/105/117105084/   2. https://nptel.ac.in/courses/106/106/106106184/   3. https://nptel.ac.in/courses/108/105/108105103/   4. https://www.youtube.com/watch?v=DKSZHN7jftI&list=PLZoTAELRMXVPGU70ZGsckrMdr0FteeRUi   5. https://www.youtube.com/watch?v=aPfkYu_qiF4&list=PLyqSpQzTE6M9gCgajvQbc68Hk_JKGBAYT

M. TECH FIRST YEAR

Course Code	AMTCSE0215	L T P	Credit
Course Title	**Modeling & Simulation**	3 0 0	3

Course objective:

1	To introduce the basic concepts of computation through modeling and simulation that are increasingly being used by architects, planners, and engineers.
2	To identify different types of models and simulations and understand the iterative development process of a model.
3	To develop simulation model using heuristic methods.
4	To analyze simulation models using input and output analyzer

Pre-requisites:

Basic Knowledge of graphs and plots, Basic programming knowledge of MATLAB, Introductory Calculus, Probability and Statistics, Introductory Physics and Numerical methods.

Course Contents / Syllabus

UNIT-I	**Introduction to modeling and simulation**	**8 Lectures**

Introduction to modeling, Examples of models, types of models, modeling of dynamic system, Introduction to simulation, MATLAB as a simulation tool, Bond graph modeling, causality, generation of system equations.

UNIT-II	**Modeling of dynamic and combined systems**	**8 Lectures**

Methods of drawing bond graph model- Mechanical systems & Electrical systems, some basic system models- Mechanical systems, Thermal systems, hydraulic systems, pneumatic systems and electrical systems.

Linearity and non-linearity in systems combined rotary and translatory system, electromechanical system, hydro mechanical system.

UNIT-III	**Dynamic Response and System Transfer Function**	**8 Lectures**

Dynamic response of 1st order system and 2nd order system, performance measures for 2nd order system, system transfer function, transfer function of 1st and 2nd order system Block diagram algebra, signal flow diagram, state variable formulation, frequency response and bode plots.

UNIT-IV	**System Simulation**	**8 Lectures**

Why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, Simulation of continuous systems, analog vs. digital Simulation, Monte-Carlo computation vs. stochastic simulation.

UNIT-V	**Simulation and simulation applications**	**8 Lectures**

Simulation using SIMULINK, examples of simulation problems- simple and the compound pendulum, planner mechanisms, validation and verification of the simulation model, parameter estimation methods, system identifications, introduction to optimization.

Course outcome:	**After completion of this course students will be able to**	
CO 1	Explain and apply basic concepts related to modeling and simulation.	K2, K3
CO 2	Implement bond graphs for the type of systems and analyze the bond graph according to causality conflicts, and from a given bond graph without conflicts.	K3,K4
CO 3	Understand conservation laws, constitutive relationships and other physical relations to model mechanical, electrical and flow systems	K2

CO 4	Understand dynamic response and transfer function using various tools for system modeling and simulation.	K2
CO 5	Simulate mechanical and electrical systems using the computer tools Simulink.	K3

Text books

Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2nd Edition. Academic press 2000

Robert L. Woods, Kent L. Lawrence, "Modeling and simulation of dynamic systems", Person, 1997.

Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis",TMH

Geoftrey Gordon, "System Simulation", PHI

Reference Books

Pratab.R " Getting started with MATLAB" Oxford university Press 2009

Brown, Forbes T. "Engineering System Dynamics", New York, NY: CRC, 2001. ISBN: 9780824706166.

Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education

 V P Singh, "System Modeling and simulation", New Age International

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=Wp3jyLkfBQs
Unit 2	https://www.youtube.com/watch?v=Nzs7Owpd2UA
Unit 3	https://www.youtube.com/watch?v=wkkNO8EtYK4 http://www.infocobuild.com/education/audio-video-courses/mechanical-engineering/ModelingSimulation-DynamicSystems-IIT-Roorkee/lecture-25.html
Unit 4	https://www.youtube.com/watch?v=Wp3jyLkfBQs
Unit 5	https://www.youtube.com/watch?v=9o48duEfm3c https://www.mathworks.com/videos/modeling-and-simulation-made-easy-with-simulink-81993.html

Course Code	AMTCSE0216	L T P	Credit
Course Title	**Advanced Computer Architecture**	3 0 0	3

Course objective:

1	Basic understanding of computer system and the design of arithmetic & logic unit, IEEEStandardforFloatingPointNumbers. .
2	Study of the concept of control unit, Micro operation and Instruction cycle & sub cycle.
3	Basic understanding of the pipeline processor, Arithmetic Pipeline Design.
4	Basic understanding of advanced processor technology, hierarchical memory system, cache memories and virtual memory.
5	Understand the Vector Processing Principles, SIMD Architecture and Programming Principles.

Pre-requisites:

1. Basic knowledge of computer Organization.
2. Logic gates and their operations.
3. Basics of Microprocessor.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 hours**

Introduction: Computer Organization and Architecture, busarchitecture,typesofbusesandbusarbitration.Register,busandmemorytransfer, Processororganization,generalregistersorganization,stackorganizationandaddressingmodes. Arithmetic&logicunitdesign,IEEEStandardforFloatingPointNumbers.

UNIT-II	**Control Unit**	**8 hours**

ControlUnit: Instructiontypes,formats,instructioncyclesandsubcycles(fetch ,decode, executeetc), microoperations,executionofacompleteinstruction,ProgramControl,Hardwireandmicroprogrammedcontrol,conceptofhorizontalandverticalmicroprogramming, Flynn's classification.

UNIT-III	**Pipelining**	**8 hours**

Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

UNIT-IV	**Processors and Memory Hierarchy**	**8 hours**

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors Memory Technology :Hierarchical memory technology, Inclusion, Coherence and Locality, Memory capacity planning, Virtual Memory Technology

UNIT-V	**Vector Processing Principles**	**8 hours**

Vector Processing Principles: Vector instruction types, Vector-access memory schemes. Synchronous Parallel Processing : SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, SIMD Computers and Performance Enhancement
Case study on Intel skylake and IBM Power8,Nvidia Maxwell

Course outcome:	**After completion of this course students will be able to**

CO 1	Understand the basic structure and operation of a digital computer system , ALU,IEEEStandardforFloatingPointNumbers	K_1, K_2,
CO 2	Understand control unit techniques and the concept of instruction cycle and sub cycle.	K_1, K_2
CO 3	Understand the concept of pipeline processor, Arithmetic Pipeline Design,	K_1, K_2
CO 4	Understand the advanced processor technology, Instruction set architectures, hierarchical memory system, cache memories and virtual memory.	K_1, K_2
CO 5	Describe the concept of Vector Processing Principles, SIMD Architecture and Programming Principles	K_1, K_2

Text books

1. M.Mano, ComputerSystemArchitecture,Pearson, 3rd Edition , 2017

2. Kai Hwang, Advanced computer architecture, TMH, 2001

3. WilliamStallings,ComputerOrganizationandArchitecture-DesigningforPerformance,PearsonEducation,Seventhedition,2006.

Reference Books

1. CarlHamacher,ZvonkoVranesic,SafwatZakyComputerOrganization,McGraw-Hill,FifthEdition,Reprint2012

2. Kai Hwang and Zu, Scalable Parallel Computers Architecture, MGH.

3. John P.Hayes, Computer Architectureand Organization,Tata McGraw Hill,Third Edition,1998.

M. TECH FIRST YEAR

Course Code	AMTCY0215	L T P	Credit
Course Title	**Software Protection**	3 0 0	3

Course objective:

1	To apply the technical knowledge and skills needed to protect and defend software.
2	To apply knowledge that can plan, implement, and monitor security mechanisms to help ensure the protection of information technology assets
3	To identify, analyze, and remediate software security breaches.
4	To apply the methods for preservation of digital evidence
5	To develop an understanding of security policies

Pre-requisites: Basic understanding in security keyterms

Basic knowledge of web applications & programming concepts &os.

Course Contents / Syllabus

UNIT-I	Software System Security: Introduction , Sample Attacks:, The Marketplace for vulnerabilities, Error 404 Hacking digital India part 1 chase. types of malware: Adware, Spyware, virus, worms, Trojan horse, rootkits , intrusion, bots, keyLogger, Ransomware, spam and pishing, case study on malwareMalwaresymptoms and their removal technique, Antivirus :definition with currently updated antivirus and their technical details.	8

UNIT-II	Hijacking & Defense: **Control Hijacking**, integer overflow ,buffer overflow, format string vulnerabilities, Language vulnerability with code **Defense** against Control Hijacking :- Platform Defense , Run-time Defenses, Advanced Control Hijacking attacks	8

UNIT-III	Various operating system security issue: **Unix security** : level of Confinement ,Detour Unix user IDs and process IDs and privileges ,System call interposition Access control methods, VM based isolation ,Confinement principle ,Software fault isolation **Windows security** : access control scheme, access token, security descriptors	8

UNIT-IV	**Advance software and network security landscape:** HTTP content rendering .Browser isolation, sql injection attack with example,Cross-Site Scripting, Cross site request forgery , **Static Code obfuscation** - In-depth Semantics preserving obfuscating transformations, complicating control flow, opaque predicates, data encoding, breaking abstractions. Obfuscation – Theoretical Bounds Various impossibility results	8

UNIT-V	**Watermarking** Definitions, Methods of Watermarking, Tamper proofing watermarks, Resilient watermarks, Stealth watermarks. Steganographic water marks, Dynamic watermarking. Software Similarity Analysis:- Alternate methos for defeating obfuscations. K-gram based analysis, API-Based analysis, Tree-based Analysis, Graph-Based analysis, Metrics-BasedAnalysis.	8

Course outcome:	After completion of this course students will be able to	
CO 1	Understand software security issues that challenge security threats and their mitigation techniques.	K2
CO 2	Discuss threats, bugs posing security threats and predict their attenuation techniques.	K2
CO 3	Analyze the operating system based threats and list their fixing methods.	K4
CO 4	Discuss networks security landscape .	K2
CO 5	Apply watermarking for protection of images.	K3

Text books

William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.

Christian Collberg and JasvirNagra, *Surreptitious Software: Obfuscation, Watermarking, and Tamperproofing for Software Protection*, Addison-Wesley, 2010

Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

Reference Books

Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software

CSS,ICT Academy IIT Kanpur course

Cyber Security: Comprehensive Beginners Guide to Learn the Basics and Effective Methods of Cyber Security

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=fQ3ESFfvchg&list=PLUtfVcb-iqn834VGI9faVXGIGSDXZMGp8
Unit 2	https://www.youtube.com/watch?v=r4KjHEgg9Wg
Unit 3	https://www.youtube.com/watch?v=akU1Ji8Vzdk&list=PLZ5dJPlUQexlMzytxuLk2uVHttBKV-1HH
Unit 4	https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7
Unit 5	https://www.youtube.com/watch?v=1vQhSm5_UqY

M. TECH FIRST YEAR			
Course Code	**AMTCY0216**	**L T P**	**Credit**
Course Title	**Information Security**	**3 0 0**	**3**

Course objective:	
1	Learn fundamentals knowledge related to Information System, Security threats, security services, and countermeasures
2	Understand application security, data security, security technology, security threats from malicious software
3	Learn the concept of physical security, criteria for selection of biometrics and design Issues in Biometric Systems.
4	Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc.
5	Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India.

Pre-requisites:

- Computer networking concepts (Internet, protocols, sockets, network applicatio programming
- Languages like C, Python, JavaScript
- Web Application's architecture and HTTP/HTTPS communication

Course Contents / Syllabus		
UNIT-I	**Introduction to Security:** Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis	**08**
UNIT-II	**Security Attacks:** Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.	**08**
UNIT-III	**Security Issues and Biometrics:** Physical Security: Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges.	**08**
UNIT-IV	**Risk Management:** Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures	**08**
UNIT-V	Security Policies, Why Policies should be developed, WWW policies, Email **Security Policies:** Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law	**08**

Course outcome: After completion of this course students will be able to		
CO 1	Understand information, information systems, information security, Cyber Security and Security Risk Analysis.	K_2
CO 2	Understand and apply application security, data security, security technology, security threats from malicious software	K_2, K_3
CO3	Understand and apply physical security, criteria for selection of biometrics and design Issues in Biometric Systems	K_2, K_3
CO 4	Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc.	K_2
CO 5	Understand and apply Information Security Governance & Risk Management, Security of IT Assets and Intrusion Detection Systems.	K_2, K_3

Text books:

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security ", Pearson Education India
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumarShukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press
4. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi India
6. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003

Reference Books:

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill,2003
3. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.

NPTEL/ Youtube/ Faculty Video Link:

1. https://www.youtube.com/watch?v=XlcolUHMnh0
2. https://www.youtube.com/watch?v=ZRxjJTYVuqU
3. https://www.youtube.com/watch?v=fdYke5rcd6I&list=RDCMUC4Kh0VSxZmLvHfRRF8wLqrA&start_radio=1&t=0
4. https://www.youtube.com/watch?v=bJmYjOfGau0
5. https://www.youtube.com/watch?v=nEOttheezYo

Course Code	AMTCSE0253	L T P	Credit
Course Title	Seminar I	0 0 2	2

Course objective:

1	Learn fundamentals knowledge related to Information System, Security threats, security services, and countermeasures
2	Understand application security, data security, security technology, security threats from malicious software
3	Learn the concept of physical security, criteria for selection of biometrics and design Issues in Biometric Systems.
4	Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc.
5	Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India.

These Departmental Guidelines should be read in conjunction with relevant regulations on program requirements on the website of the Noida institute of Engineering and Technology, Greater Noida.

1. Purpose of the Research Seminar

The purpose of the Research Seminar is for students to share aspects of their research as it develops with their advisors and other interested academics and students. As such, it serves to encourage students to synthesize the evidence they have gathered thus far, thereby helping them to marshal their materials into manageable form as their research proceeds. Further, students will receive feedback from others interested in their area of study, assisting them in considering aspects they might not otherwise have addressed. Sharing material with others in the Department also spreads the research: if staff and other students are aware of what graduates are researching, they can refer relevant material to them as they come across it. The Seminar also serves as a training space for preparation and presentation of papers at academic conferences.

2. Functions of a Seminar/Research Paper

A seminar paper is the written analysis of a particular topic specified in the seminar. It has to fulfill all requirements for a scientific article: the ideal seminar paper resembles a journal article. Any research paper is a means of communication between the researcher and the academic community. Sometimes it may also address other groups such as policy makers or NGOs (Non Governmental Organizations). The fundamental goal of all research papers is to contribute to the existing body of literature in their fields.

A seminar paper is also an excellent opportunity to exercise scientific writing before writing a thesis. In order to get the maximum learning effect from this opportunity, we suggest that you contact your supervisor at least three times during preparing your paper: first, in order to fix the topic, second, if you have developed the structure of the envisaged paper and third, with a(n almost) complete version before submitting it.

3. Things to Do Before Starting to Write a Seminar Paper

- Fix a specific topic in accordance with your supervisor.
- Get a first overview of the existing literature (literature review is one of the important parts of your work for a seminar paper. Generally, this is in your own responsibility, but you may get hints from your supervisor).
- Specify the structure in accordance with your supervisor.

4. Structure and Elements of a Seminar Paper

4.1 General Approach

Any survey based seminar/research paper has to include an abstract, topic introduction in detail, current issues in the current or gaps in the research topic, detailed literature in reference to the introduction, a brief analysis of previous research work, conclusion and at the end of the paper, a list of references. Furthermore, there are at least three basic elements in a seminar paper: introduction, identified gaps in the literature, and discussion of the findings.

4.2 Abstract

It describes the essence, the main theme of the paper. It includes the research question posed, its significance, the methodology, and the main results or findings. Not every education paper requires an abstract. However, for longer, more complex papers abstracts are particularly useful. Often only 100 to 300 words, the abstract generally provides a broad overview and is never more than a page.

4.3 Introduction

The first section of the seminar paper is the introduction. The introductory section should establish the importance of the topic, define a meaningful research gap, and explain how the present paper attempts to fill the gap. The introduction should also explicitly outline the contributions of the paper. An introduction ends with explaining the organization of the rest of the paper. The key purpose of the introduction is to motivate the reader to read the rest of the paper. Examples of good introductions can be found in good journal articles.

4.3 Body of the Research Paper

In theory, the purpose of this part is simple. It describes how the research question was answered. In practice, there are many ways to organize this part. However, in seminar papers, the common approach is to write a literature review. Empirical studies are also welcome but not required. For papers focusing on literature review, there are many alternatives for structuring the body part. The topic and the selected approach largely determine the optimal structure. Please refer to relevant analogous journal articles or other research papers for identifying structures that could work in your case and agree upon a structure with your supervisor.

4.4 Discussion of the Findings and Conclusions

This section discusses the findings and their implications. The author should derive own conclusions based on the body of the research and not only repeat conclusions found in other papers. Also, limitations and suggestions for future research can be discussed.

5. Guidelines for the Layout and Style of the Seminar Paper

5.1 Layout

The structure of the paper should consist of numbered headings. Text should be in 12 point font (Times New Roman), double-spaced, with single-spaced footnotes (please use footnotes, not end notes). Footnotes should be numbered consecutively and should appear on the same page. Pages should be numbered. The minimum length for a seminar paper is 6 pages, the maximum 15. All tables and figures should be numbered consecutively and have a title. The sources need to be given below the table/figure.

5.2 Style

A few notes on style:

- Always structure your work in advance.

- Know what you want to say before trying to write it.

- Each sentence must follow logically from the one before. A well written text is a "chain of ideas".

- While writing, keep your reader's needs in mind. This means providing a "verbal map" of your document so that your reader knows what to expect, and placing "verbal signposts" in your text to explain what is coming next.

- At the end, proof-read your work carefully and check your spelling and grammar. Ask a friend or relative to read your proposal.

- Don't use words when you are not absolutely certain of their meaning and don't use difficult words to impress your reader. Avoid repetitions.

- Choose for British English or American English language – don't mix. Some examples of differences between American English and British English are listed below (for more consult dictionaries such as http://dict.leo.org/)

6. Guidelines for References

6.1 General Idea

References are one of the most important parts of writing a scientific text. Anytime you take a thought from another published source, this must be referenced with the author's name and the year of publication. Full details of the publication must be given at the end of the paper in a reference list. Failure to properly referencing your text, and particularly copying text directly from internet sources, other papers or books without referencing constitutes intellectual theft. Intellectual theft will have serious consequences which may include a non-pass grade or, in serious cases and with exam theses, ex-matriculation.

6.2 References in the Text

The reference in the text can be written in many styles such as:

a. **MLA Style** [Dehraj, Pooja, and Arun Sharma. "An empirical assessment of autonomicity for autonomic query optimizers using fuzzy-AHP technique." *Applied Soft Computing* 90 (2020): 106137.]

b. **APA Style** [Dehraj, P., & Sharma, A. (2020). An empirical assessment of autonomicity for autonomic query optimizers using fuzzy-AHP technique. *Applied Soft Computing*, *90*, 106137.]

c. **Chicago Style** [Dehraj, Pooja, and Arun Sharma. "An empirical assessment of autonomicity for autonomic query optimizers using fuzzy-AHP technique." *Applied Soft Computing* 90 (2020): 106137.]

d. **Harvard Style** [Dehraj, P. and Sharma, A., 2020. An empirical assessment of autonomicity for autonomic query optimizers using fuzzy-AHP technique. *Applied Soft Computing*, *90*, p.106137.]

e. **Vancouver Style** [Dehraj P, Sharma A. An empirical assessment of autonomicity for autonomic query optimizers using fuzzy-AHP technique. Applied Soft Computing. 2020 May 1;90:106137.]

6.3 Reference List

In the reference list at the end of the paper, all references cited in the text are to be listed in alphabetic order. There are many options of format. If you consult the websites of scientific journals you will find that most of them have their "house style". Most important features for the reference list are
- Completeness: give full details (author or authors, year of publication, title and publisher)
- Consistency (use the same approach for all publications).

7. Hints for Searching Literature

The two key methods for searching literature are:

- Find the most relevant and important pieces of research on the topic area and track the references used in them.

- Conduct literature searches in databases (and Google…) using identified key terms. If scanning a lot of literature, it is difficult to keep in mind what the one was about which one read two weeks ago. Therefore, it is often useful to take notes on previously read papers and summarizing the most important content, for example by creating summary tables.

8. Presentations

Some hints for your presentations:

- The maximum time for your seminar paper presentation is 20 minutes in order to have enough time for discussion. Check whether you get along with your presentation within 20 minutes before!

- Give an outline of your presentation in the beginning.

- It is supporting for the audience if you bring a printout of your presentation (if prepared in Power Point, you can print 6 pages on one A4 sheet).

- Select a sufficiently large font (not below 26 pt for Times New Roman).

- A matter of taste, but please: choose colors and animation judiciously and consistently. Nothing is as unnerving as a slide that looks like a box of M&Ms or a presentation which is animated as a video clip. So, employ animations in a goal-oriented and limited fashion.

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M. TECH SECOND YEAR			
Course Code	**AMTAI**	**L T P**	**Credit**
Course Title	Seminar II	**0 0 6**	**6**
Course objective:			
1	Learn fundamentals knowledge related to Information System, Security threats, security services, and countermeasures		
2	Understand application security, data security, security technology, security threats from malicious software		
3	Learn the concept of physical security, criteria for selection of biometrics and design Issues in Biometric Systems.		
4	Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc.		
5	Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India.		

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A seminar paper is the written analysis of a particular topic specified in the seminar. It has to fulfill all requirements for a scientific article: the ideal seminar paper resembles a journal article. Any research paper is a means of communication between the researcher and the academic community. Sometimes it may also address other groups such as policy makers or NGOs (Non Governmental Organizations). The fundamental goal of all research papers is to contribute to the existing body of literature in their fields.

A seminar paper is also an excellent opportunity to exercise scientific writing before writing a thesis. In order to get the maximum learning effect from this opportunity, we suggest that you contact your supervisor at least three times during preparing your paper: first, in order to fix the topic, second, if you have developed the structure of the envisaged paper and third, with a(n almost) complete version before submitting it.

3. Things to Do Before Starting to Write a Research Paper

• Fix a specific topic in accordance with your supervisor.

• Get a first overview of the existing literature (literature review is one of the important parts of your work for a seminar paper. Generally, this is in your own responsibility, but you may get hints from your supervisor).

• Specify the structure in accordance with your supervisor.

4. Structure and Elements of a Seminar/Research Paper

4.1 General Approach

Any seminar/research paper has to include an abstract, topic introduction in detail, current issues in the current or gaps in the research topic, detailed literature in reference to the introduction, Approach or methodology need to be followed for any empirical work, a brief analysis of its own work with respect to already proposed work, conclusion and at the end of the paper, a list of references. Furthermore, there are at least three basic elements in a seminar paper: introduction, identified gaps in the literature, methodology and discussion of the findings.

4.2 Abstract

Not every education paper requires an abstract. However, for longer, more complex papers abstracts are particularly useful. Often only 100 to 300 words, the abstract generally provides a broad overview and is never more than a page. It describes the essence, the main theme of the paper. It includes the research question posed, its significance, the methodology, and the main results or findings. Footnotes or cited works are never listed in an abstract. Remember to take great care in composing the abstract. It's the first part of the paper the instructor reads. It must impress with a strong content, good style, and general aesthetic appeal. Never write it carelessly.

4.3 Introduction and Problem Statement

A good introduction states the main research problem and thesis argument. What precisely are you studying and why is it important? How original is it? Will it fill a gap in other studies? Never provide a lengthy justification for your topic before it has been explicitly stated. For empirical papers, the structuring is commonly quite straightforward. First, previous literature is reviewed in detail. Second, hypotheses are developed building on the existing body of knowledge. Third, the methodology used in the hypothesis testing is described. Fourth, the results from the tests of the hypotheses are reported.

4.4 Literature Review

The research process uncovers what other writers have written about your topic. Your education paper should include a discussion or review of what is known about the subject and how that knowledge was acquired. Once you provide the general and specific context of the existing knowledge, then you yourself can build on others' research

4.5 Limitations of the Study

Indicate as soon as possible what you intend to do, and what you are not going to attempt. You may limit the scope of your paper by any number of factors, for example, time, personnel, gender, age, geographic location, nationality, and so on.

4.6 Methodology

Discuss your research methodology. Did you employ qualitative or quantitative research methods? Did you administer a questionnaire or interview people? Any field research conducted? How did you collect data? Did you utilize other libraries or archives? And so on.

4.7 Analysis of the Research Work

This is generally the most important part of the paper. It's where the author supports the work and builds the argument. It contains most of the citations and analysis. This section should focus on a rational development of the thesis with clear reasoning and solid argumentation at all points. A clear focus, avoiding meaningless digressions, provides the essential unity that characterizes a strong education paper.

4.8 Conclusion

After spending a great deal of time and energy introducing and arguing the points in the main body of the paper, the conclusion brings everything together and underscores what it all means. This section discusses the findings and their implications. The author should derive own conclusions based on the body of the research and not only repeat conclusions found in other papers. A stimulating and informative conclusion leaves the reader informed and well-satisfied. Also limitations and suggestions for future research can be discussed.

5. Guidelines for the Layout and Style of the Research Paper

5.1 Layout

The structure of the paper should consist of numbered headings. Text should be in 12 point font (Times New Roman), double-spaced, with single-spaced footnotes (please use footnotes, not end notes). Footnotes should be numbered consecutively and should appear on the same page. Pages should be numbered. The minimum length for a seminar paper is 10 pages, the maximum 20. All tables and figures should be numbered consecutively and have a title. The sources need to be given below the table/figure.

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A few notes on style:

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• At the end, proof-read your work carefully and check your spelling and grammar. Ask a friend or relative to read your proposal.

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6. References

6.1 General Idea

References are one of the most important parts of writing a scientific text. Anytime you take a thought from another published source, this must be referenced with the author's name and the year of publication. Full details of the publication must be given at the end of the paper in a reference list. Failure to properly referencing your text, and particularly copying text directly from internet sources, other papers or books without referencing constitutes intellectual theft. Intellectual theft will have serious consequences which may include a non-pass grade or, in serious cases and with exam theses, ex-matriculation.

6.2 References in the Text

For knowing more about the styles and presentation, the following references should be followed:

Journal Research Papers:

1. Nintanavongsa, Prusayon, Ufuk Muncuk, David Richard Lewis, and Kaushik Roy Chowdhury. "Design optimization and implementation for RF energy harvesting circuits." IEEE Journal on emerging and selected topics in circuits and systems 2, no. 1 (2012): 24-33.

2. Lee, Hoon, Sang-Rim Lee, Kyoung-Jae Lee, Han-Bae Kong, and Inkyu Lee. "Optimal beamforming designs for wireless information and power transfer in MISO interference channels." IEEE Transactions on Wireless Communications14, no. 9 (2015): 4810-4821.

3. Mo, Jeonghoon, Hoi-Sheung Wilson So, and Jean Walrand. "Comparison of multichannel MAC protocols." IEEE Transactions on mobile computing 7, no. 1 (2008): 50-65.

Magazines:

4. Candès, Emmanuel J., and Michael B. Wakin. "An introduction to compressive sampling [a sensing/sampling paradigm that goes against the common knowledge in data acquisition]." IEEE signal processing magazine 25, no. 2 (2008): 21-30.

5. Leaves, Paul, Klaus Moessner, Rahim Tafazolli, David Grandblaise, Didier Bourse, Ralf Tonjes, and Michele Breveglieri. "Dynamic spectrum allocation in composite reconfigurable wireless networks." IEEE Communications Magazine 42, no. 5 (2004): 72-81.

6. Demestichas, Panagiotis, Guillaume Vivier, Karim El-Khazen, and M. Theologou. "Evolution in wireless systems management concepts: from composite radio environments to reconfigurability." IEEE Communications Magazine 42, no. 5 (2004): 90-98.

Conference Papers:

7. Clancy, T. Charles. "Achievable capacity under the interference temperature model." In IEEE INFOCOM 2007-26th IEEE International Conference on Computer Communications, pp. 794-802. IEEE, 2007.

8. Pandharipande, Ashish, and J-PMG Linnartz. "Performance analysis of primary user detection in a multiple antenna cognitive radio." In 2007 IEEE International Conference on Communications, pp. 6482-6486. IEEE, 2007.

9. Zheng, Haitao, and Chunyi Peng. "Collaboration and fairness in opportunistic spectrum access." In IEEE International Conference on Communications, 2005. ICC 2005. 2005, vol. 5, pp. 3132-3136. IEEE, 2005.

Symposium Papers:

10.Buddhikot, Milind M., Paul Kolodzy, Scott Miller, Kevin Ryan, and Jason Evans. "DIMSUMnet: new

directions in wireless networking using coordinated dynamic spectrum." In Sixth IEEE International Symposium on a World of Wireless Mobile and Multimedia Networks, pp. 78-85. IEEE, 2005.

11. Pérez-Romero, Jordi, Oriol Sallent, Ramón Agustí, and Lorenza Giupponi. "A novel on-demand cognitive pilot channel enabling dynamic spectrum allocation." In 2007 2nd IEEE international symposium on new frontiers in dynamic spectrum access networks, pp. 46-54. IEEE, 2007.

12. Raman, Chandrasekharan, Roy D. Yates, and Narayan B. Mandayam. "Scheduling variable rate links via a spectrum server." In First IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks, 2005. DySPAN 2005, pp. 110-118. IEEE, 2005.

Workshop Papers:

13. Mitola Iii, Joseph. "Cognitive radio for flexible mobile multimedia communications." Mobile Networks and Applications 6, no. 5 (2001): 435-441.

14. Holland, Oliver, Vasilis Friderikos, and A. Hamid Aghvami. "Green spectrum management for mobile operators." In 2010 IEEE Globecom Workshops, pp. 1458-1463. IEEE, 2010.

15. Cabric, Danijela, Artem Tkachenko, and Robert W. Brodersen. "Experimental study of spectrum sensing based on energy detection and network cooperation." In Proceedings of the first international workshop on Technology and policy for accessing spectrum, p. 12. ACM, 2006.

Books:

16. Marsch, Patrick, and Gerhard P. Fettweis, eds. Coordinated Multi-Point in Mobile Communications: from theory to practice. Cambridge University Press, 2011.

17. Xiao, Yang, and Fei Hu, eds. Cognitive radio networks. CRC press, 2008.

18. Caso, Giuseppe, Mai T. Phuong Le, Luca De Nardis, and Maria-Gabriella Di Benedetto. "Non-cooperative and cooperative spectrum sensing in 5G cognitive networks." Handbook of Cognitive Radio (2017): 1-21.

Book Chapter:

19. Karygiannis, Tom, and Les Owens. "Wireless network security." NIST special publication 800 (2002): 48.

20. Frankel, Sheila, Bernard Eydt, Les Owens, and Karen Scarfone. "Establishing wireless robust security networks: a guide to IEEE 802.11 i." National Institute of Standards and Technology (2007).

21. Karygiannis, Tom, and Les Owens. "Wireless network security." NIST special publication 800 (2002): 48.

Thesis:

22. Mitola III, Joseph. "Cognitive radio: an integrated agent architecture for software radio." Royal Institute of Technology (KTH) (2000).

23. Lehtomaki, Janne. "Analysis of energy based signal detection." Ph. D. Thesis, University of Oulu (2005).

24. Luo, Chenchi. "Non-uniform sampling: algorithms and architectures." PhD diss., Georgia Institute of Technology, (2012).

Dissertation:

25. J. Mitola, "Cognitive radio: An integrated agent architecture for software defined radio," Ph.D. dissertation, KTH Royal Inst. of Technol., Stockholm, Sweden, 2000.

26.Sharma, Shree Krishna. "Interweave/underlay cognitive radio techniques and applications in satellite communication systems." PhD diss., University of Luxembourg, Luxembourg, 2014.

27.Duarte, Melissa. "Full-duplex wireless: Design, implementation and characterization." PhD diss., Rice University, 2012.

Report:

1. Force, FCC Spectrum Policy Task. "Report of the spectrum efficiency working group." *http://www. fcc.gov/sptf/files/SEWGFinalReport_1. pdf* (2002).

2. DARPA, ATO. "Next Generation (XG) Program." http://www.darpa.mil/ato/programs/xg/ index.htm.

3. Mobile VCE. Green Radio, Aug. (2015). [Online]. Available: http://www.mobilevce.com/green-radio

Licentiate Proposal:

1. J. Mitola, "Cognitive Radio." Licentiate proposal, KTH, Stockholm, Sweden.

7. Presentations

Some hints for your presentations:

• The maximum time for your seminar paper presentation is 20 minutes in order to have enough time for discussion. Check whether you get along with your presentation within 20 minutes before!

• Give an outline of your presentation in the beginning.

• It is supporting for the audience if you bring a printout of your presentation (if prepared in Power Point, you can print 6 pages on one A4 sheet).

• Select a sufficiently large font (not below 26 pt for Times New Roman).

• A matter of taste, but please: choose colors and animation judiciously and consistently. Nothing is as unnerving as a slide that looks like a box of M&Ms or a presentation which is animated as a video clip. So, employ animations in a goal-oriented and limited fashion.

• Only write on the slide what you will actually refer to in the talk, and keep the slides isomorphic with your oral presentation. Otherwise, while you are speaking, the audience will be distracted by reading the diverging content on your slides.

• Putting complex slides up only for a few seconds and not referring to their content or mention their essential point is a bad habit that is widespread. So the rule is: If you do not talk about it, do not put it on the slide.

• Sometimes you cannot avoid using slides that are complex and of which you only address excerpts. In this case you should let the audience know that you do not expect them to understand the whole slide. Otherwise they will try to do so, be distracted and possibly miss important material. By the same token, if you include forward references in the talk, i.e., if you mention points that you explain in more detail later (or never), then you explicitly have to say so. Otherwise the audience will ponder what they should understand and what comes later or never, and again they will be distracted.

GUIDELINES FOR PREPARING THE THESIS

Master of Technology (M. Tech)

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

LIST OF CONTENT

GUIDELINES FOR PREPARING THE THESIS

1. GENERAL

As enshrined in the Acts, Regulations and Ordnances of the research, in general, encompass the discovery of new facts or techniques or correlation of facts already known, through analytical or experimental approach or both, while demonstrating a quality potential as to make a definite contribution to the advancement of knowledge useful to the society and the scholar's ability to undertake sustained research in future. Accordingly, a thesis being a documented manifestation of the above objectives, shall report, in an organized and scholarly fashion, an account of the original research work of the scholar and present the findings in an appropriate manner with actual accomplishments of the work plainly stated and honestly appraised.

The purpose of this manual is to provide broad guidelines to the M. Tech candidates for the preparation of the thesis. It lists the general and specific requirements governing the thesis preparation including guidelines for structuring the contents. The candidates are advised to have thoroughly gone through the up-to-date M. Tech Ordnances, and other relevant announcements brought out from time to time by the University. Further, for style, structure and presentation of a very special type of work specific to a particular field, the scholar may refer to additional style manuals or reference guides and to the published literature in their respective fields of study.

2. ARRANGEMENT OF THE CONTENTS OF THESIS

The sequence in which the thesis contents should be arranged and bound should be as follows:

1. Cover Page and Title Page
2. Declaration
3. Bonafide Certificate
4. Abstract
5. Acknowledgements
6. Table of Contents
7. List of Tables
8. List of Figures
9. List of Symbols, Abbreviations and Nomenclature
10. Chapters 1, 2…
11. References
12. Appendices
13. List of Publications (out of the candidate's present work)
14. Curriculum Vitae (of the candidate)

3.1. Page Dimensions, Margins and Quality

The page dimensions of the final copies of the thesis should be 290mm x 205mm. Standard A4 size (297mm x 210mm) paper may be used for preparing the copies. It should have the following page margins:

Top edge	:	25 mm,	Bottom edge	:	25 mm
Left side	:	35 mm,	Right side	:	25 mm.

The thesis should be prepared on good quality white paper preferably not lower than 80 gsm.

Tables and figures should be prepared on good quality paper preferably not lower than 80 gsm. Tables and figures should conform to the margin specifications. Large size figures should be photographically or otherwise reduced to the appropriate size before insertion.

3.2. *Cover Page/ Title Page*

A specimen of the cover/title page is given in the Annexure I. It carries

a. The TITLE of the thesis (Times New Roman, font size 20, bold, single line spacing, all character's uppercase except the symbols and numerals if used in the title of the thesis; centered within the specified margin of the page).

TITLE OF THESIS TITLE OF THESIS TITLE OF THESIS TITLE OF THESIS

b. The phrase (Times New Roman, font size 14, bold, each line in the Title/Sentence mode, single line spacing, centered within the specified margin of the page).

<div align="center">

A Thesis Submitted
in Partial Fulfillment of the Requirements
for the Degree of

</div>

c. The name of the degree (Times New Roman, font size 20, bold, the whole line in uppercase, centered within the specified margin of the page).

<div align="center">

MASTER OF TECHNOLOGY

</div>

Note: In case of M. Tech gap of16-18 Times New Roman pts, it will be followed by

<div align="center">

in

Field of Specialization

</div>

were

in (Times New Roman, font size 14, bold, both the characters lower case, centered within the specified margin of the page).

Field of   Specialization (Times New Roman, font size 16, bold, in Title Mode, centered within the specified margin of the page).

d. **by** (Times New Roman, font size 14, bold, both the characters lower case, centered within the specified margin of the page).

<div align="center">

by

</div>

e. **NAME OF STUDENT** (Times New Roman, font size 16, bold, full name as enrolled, all characters in Title mode case, centered within the specified margin of the page).

<div align="center">

Name of Student

</div>

f. (Enrollment Number) (Times New Roman, font size 12, bold, all numerals within a pair of small parenthesis, underneath the name of candidate and centered within the specified margin of the page).

<div align="center">

(Enrollment no. xxxxxxxxx)

</div>

g. Phrase of supervision (Times New Roman, font size 12, bold, line in the Title mode, centered within the specified margin of the page).

<div align="center">

Under the Supervision of

</div>

h. NAME(S) OF SUPERVISOR (Times New Roman, font size 14, bold, full name in title mode prefixed by Prof. or Dr. centered within the specified margin of the page, separated symmetrically in case of two supervisors, use the next line in case of three supervisors; brief one-line mention of the names of the institution of the supervisors).

<div align="center">

Prof. C S Yadav
Noida Institute of Engineering and Technology

</div>

i. University logo (size = 30 mm diameter)

j. Phrase for the name of faculty (Times New Roman, 12/14 pts., bold, full name of the
University faculty in title mode, centered within the specified margin of the page).

<div align="center">

to the
Faculty of (Name of the Faculty)

</div>

For example,

Faculty of Applied Sciences

k. Name of the University (Times New Roman, font size 16/14, bold, full name, all character's upper case/Title mode, centered within the specified margin of the page).

l. Month, Year ((Times New Roman, font size 14, bold, full name of the month in title mode, comma, 4-digit year in Arabic, all centered within the specified margin of the page).

July, 2021

3.3. *Declaration and Bonafide Certificate of Supervision*

The Declaration of Candidate of the thesis shall be in double line spacing using Times New Roman font size 12, as per the format shown in Annexure

III. The heading **DECLARATION** Times New Roman font size 14 bold in the center should start about 70mm from the top of the page. The certificate shall carry the supervisor's signature in original.

The Bonafide Certificate of Supervision of the thesis by the supervisor(s) shall be in double line spacing using Times New Roman font size 12, as per the format shown in Annexure IV. The heading **CERTIFICATE** Times New Roman font size 14 bold in the center should start about 70 mm from the top of the page. The certificate shall carry the supervisor's signature in original and shall be followed by the supervisor's name, academic designation (not any other responsibilities of administrative nature), department and full address of the institution where the supervisor has guided research scholar.

In case of two supervisors, the details about the signature, names, etc. mentioned above shall be centered symmetrically within the specified margin of the page. In case of three supervisors, the details of the third supervisor will appear in the centre underneath the first two.

The place and date of signature (left justified) common for all the supervisors will appear below the signature(s) of the supervisor(s).

3.4. *Abstract*

Abstract should be an essay type of narration not exceeding four pages outlining the research problem, the methodology used, a summary of the findings, possible applications of the research, and suggestions/directions for future research. The abstract should not contain cross citations. It should be typed single line spacing, in Times New Roman with font size 12 within the specified margin of the page. It should begin with the heading as the title of the thesis in title mode centered (bold), the name of candidate (next line) centered, and then **"ABSTRACT"** with font size 14, bold and centered. The text of abstract should begin thereafter.

3.5. *Acknowledgements (optional)*

Acknowledgements shall be brief and should not exceed one page when typed in single spacing Times New Roman with font size 12 within the specified margin of the page. It should begin with title **ACKNOWLEDGEMENTS** Times New Roman with font size 14 bold as heading placed in centre. The signature of the candidate shall be made at the bottom right end above his./her name typed in title case.

3.6. *Table of Contents*

The table of contents should list all the contents following this section. The preceding section like the Title Page, Certificate and Acknowledgements will not find a place amongst the items listed in the Table of Contents, but the page numbers in lower case Roman letters shall be accounted for them. The title **TABLE OF CONTENTS** in Times New Roman with size 14 bold as heading is placed in centre. **One and a half spacing** should be adopted for typing the contents in a manner shown in specimen copy of the Table of Contents as given in Annexure V.

3.7. *List of Tables*

The list of tables should use exactly the same numbers and captions as they appear above the tables in the text. See sections 3.11 and 5.3 for the style of titling, numbering and placing of tables. Single spacing in Time New Roman with size 12 should be used.

3.8. *List of Figures*

The list of figures should use exactly the same numbers and captions as they appear below the figures in the text. See section 3.11 and 5.3 for the style of titling, numbering and placing of figures. Single spacing in Time New Roman with size 12 should be used.

3.9. *List of Symbols, Abbreviations and Nomenclature*

Single spacing in Time New Roman with size 12 should be used typing the matter under this head. As far as possible, standard and popularly used symbols, abbreviations etc. should be adopted.

3.10. *Chapters*

Chapters of a thesis may be broadly divided into 3 parts (i) introduction, literature survey and identification of problem and issues (ii) statement, formulation and presentation of the problem, solution approach (iii) findings, results, discussion, implementation and conclusions, and directions for future research.
Each part may be suitably divided into several chapters, and a chapter may be further divided into several sections and sub-sections, sub-sub-sections.
Each chapter should be given an appropriate title.
Tables and figures in a chapter should be typed in title mode in single space in Time New Roman with font size 12. The titles of tables should be placed directly above the table whereas the titles of figures should be placed directly

underneath the figure in the very same page which refers to the contents they annotate.

Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page which refers to the material they annotate.

3.11. *Tables and figures*

By the word Table is meant the representation of tabulated numerical as well as non-numerical data in the body of the thesis and also in the appendices. All other non-verbal material used in the body of the thesis and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures. A proper representation of a table or a figure and its placement immensely add to the ability to comprehend the work. Here are few suggestive guide lines in this regard which, of course, in no way substitute the ingenuity and creativity of an author.

A table or figure including its caption should be accommodated within the prescribed margin limits and should appear on the page where its reference is made or on the page following the page in case it is not possible to place it on the same page.

Table and figures on half or less in length should necessarily appear on the same page along with the text. However, they should be separated from the text both above and below by double spacing.

All tables and figures should be prepared on the same paper or material used for the preparation of the rest of the thesis.

Captions of table/figures may use characters, numerals or symbols in the title mode.

Two or more small tables or figures may be grouped, if necessary, on a single page.

Wherever possible, the entire color photographs(s) may be reproduced on a full sheet of photographic paper. More than one photograph can be included on a page. Samples of fabric leather, etc., if absolutely necessary may be attached evenly in a page and fixed/ pasted suitably and should be treated as figures.

3.12. *Citation of References in the Thesis*

Any work of other researchers used either directly or indirectly used in the research must be indicated at appropriate places in the thesis. It could be a journal paper, a paper in conference proceedings, a monograph, a personal communication, or a book; in physical or electronic form. The standard should be followed as given below:

- If more than two authors the "Sir name of the first author et al. []"
  e.g., [73] A. Rao, R. K. Singh, and N. Srivastava, "In band Full-duplex Radio: A survey" in International Journal of Applied Engineering Research, 2019, vol I, pp. 81-86. **Should be cited as Rao et al. [73]**
- If two authors then "Sir name of first and Sirname of second author []"
  e.g., [79] S. Sawyer and P.J. Guiman, "Software Development: Processing and Performance," BM Syst. J.,vol 37, no. 4, pp. 552-569, 1998. **Should be cited** as Sawyer and Guinan [79]
- If single author paper then "Full name of author []"

e.g., [72] R. Snijders, "Crowed Centric Requirements," in International Conference on Utility and Cloud Computing, 2014, pp. 614-615. **Should be cited as** R. Snijders [72]

3.13. *Listing of References in the REFERENCE section*

The listing of references should be typed in alphabetical order of the first author's name in single spacing starting 4 spaces below the heading **REFERENCES** in Times New Roman with font size 14 bold. The references should be serially numbered, separated by single space. For typing the references, Times New Roman with font size 11 is recommended. Few suggestive examples given in section 8 should be followed for referencing.

3.14. *Appendices*

Appendices in a thesis are provided to give supplementary information, which if included in the main text may serve as a distraction and could tend to dilute the central theme under discussion.

Each appendix must find its reference in the main body of the thesis.

Appendices shall carry the title of the contents reported and the same title shall be made in the contents page also.

Appendices should be numbered using Roman numerals in upper case, e.g. Appendix I, Appendix II, etc.

Figures, tables, equations and references appearing in appendices should be numbered locally to an appendix e.g. II.1, II.2, III.5, etc. and should be referred to at appropriate places just as in the case of chapters.

3.15. *List of Publications of the Candidate*

The list of publications made by research scholar during the period of research and pertaining to the thesis submitted for the degree should be listed in **chronological order** in the order of international refereed journals, national refereed journals, proceedings of the conferences, in the same style as followed in providing the list of references (section 8). The publications wherever is relevant should be referred to in the main body of the thesis.

3.16. *Curriculum Vitae*

A vita mentioning the salient achievements and potentialities of the candidate shall be made at the end of the thesis starting 4 spaces below the heading **Curriculum Vitae** (in Times New Roman with font size 14 bold) and shall be made in preferably three paragraphs in single spacing using Times New Roman using 12 size and shall be restricted to a single page.

4. *TYPING INSTRUCTIONS*

This section includes additional information for final typing of the thesis. Some information given earlier under "Manuscript Preparation" shall also be referred to.

4.1 General

/ Duplicated/ printed copies should be black in colour.

Certain symbols characters or markings not found in a standard word processor may be hand written using Indian ink or a stylus pen (in case stencil sheets are used). Corrections, interlineations and crossing out of letters or words is not permitted in any of the copies of the thesis intended for submission. Erasures, if made, should be neatly carried out in all copies.

A sub-heading at the bottom of a page must have at least **one** full line below it or else it should be carried over to the next page.

The last word of any page should not be split using a hyphen.

Line spacing of **1.15** should be used for typing the general text. The general text shall be typed in font Style Times New Roman and Font Size 12.

- Line spacing of **1.15** should also be used for typing:
- Long Tables
- Long quotations
- Foot notes
- Multilane captions
- References

All quotations exceeding one line should be typed in an indented space - the indentation being 15mm from either margin.

4.2 Chapters, Sections, Sub-sections, and Paragraphs

The format for typing Chapter headings, Section headings and sub-section headings are explained through the following illustrative examples.

Chapter headings	:	CHAPTER 1
		INTRODUCTION
Section	:	1.1 OUTLINE OF THESIS
Sub-section heading	:	1.1.1 Literature Review

The word **CHAPTER (no.)** without punctuation should be centered 50mm down from the top of the page. Two spaces below, the title of the chapter should be typed centrally in upper case (capital letters) **TITLE OF THE CHAPTER**. The text should commence 4 spaces below this title, the first letter of the text starting 10mm, inside from the left-hand margin.

The section or sub-section headings preceded by their numberings should be left-justified. The typed material directly below section or sub-section headings should commence **one** space below it and should be offset 10mm from the left- hand margin. The text can be divided over paragraphs within a section or sub-section. Each paragraph should commerce one space below the last line of the preceding paragraph, the first letter in the paragraph being indented from the left-hand margin by 10mm. The last paragraph of any heading should follow two spaces before the next section heading.

5. NUMBERING INSTRUCTIONS

5.1. Page Numbering

The preliminary pages of the thesis (such as Titlepage, Acknowledgement, Table of Contents etc.) should be numbered in lower case Roman numerals e.g. (i), (ii), (iii), …. The Title page, however, will be treated numbered as (i) but this will not be typed. The page immediately following the title page shall be numbered (ii) and it should appear at the bottom center of the page, and so on. Pages of the main text, starting with Chapter 1 should be consecutively numbered using Arabic numerals e.g., 1, 2, …. All page numbers (whether Roman or Arabic) should be typed without punctuation in the center of the page 15mm above from the bottom.

5.2. Numbering of Chapters, Sections and Sub-sections

The numbering of Chapters, sections and sub-sections should be done using Arabic numerals only and further decimal notation should be used for numbering the sections and sub-sections within a chapter. For examples sub-section 4 under section 3 of chapter 2 should be numbered as **2.3.4**. The heading for a section or a sub-section should immediately follow in the same line after the number with line spacing of 1.15 in between.

Appendices and their sections and sub-sections should be numbered in an identical manner using upper case Roman e.g. I, II, starting with Appendix I.

5.3. Numbering of Tables and Figures

Tables and figures appearing anywhere in the thesis should bear appropriate numbers.

The rule for assigning such numbers is illustrated through an example. If a figure in Chapter 3, happens to be the fourth then **Fig. 3.4** is assigned to that figure. Identical rules apply for tables except that the word figure is replaced by the word Table. If figures (or tables) appear in appendices, for example the third figure in Appendix II will be designated as **Fig. II.3**. If a table is to be continued into the next page, then a line should be drawn underneath an unfinished table and the phrase <u>continued on page no…</u> placed on the right side and underlined should be typed just below the line. The top line of the table continued on the next page should, for example read <u>Table 2.1 (continued)</u> placed centrally and underlined.

While referring to a figure or table in the body of the thesis it should be referred to as Fig. 3.4, Table 2.1, Table II.6, and so on.

Equations appearing in each Chapter or Appendix should be numbered serially, the numbering commencing afresh for each Chapter or Appendix. For example, the eighth equation in Chapter 2, should be numbered as (2.8) thus:

5.4. A Numbering of Equations $= \pi r^2$ (2.8)

While referring to this equation in the body of the thesis it should be referred to as Eq. (2.8).

6. THESIS SUBMISSION AND BINDING SPECIFICATIONS

6.1. *Preparation of Research Summary*

After the completion of the research work and preparation of the draft thesis, a research summary is to be prepared in close contact with the thesis supervisor(s). It should begin with the title of the thesis (in Times New Roman with size 14 bold, centered), a single space gap, followed by the name and enrollment of the candidate (in Times New Roman with size 12 bold, centered) and then a single space gap followed by the title **Research Summary** (in Times New Roman with size 12 bold, centered). After a gap of a space, the text should begin on the same page (there is no need for a title page).

Like the thesis, the Research Summary may be broadly divided into parts:
(i)   introduction, literature survey and identification of problem and issues.
(ii)   statement, formulation and presentation of the problem, solution approach.
(iii) findings, results, discussion, implementation and conclusions, and directions for future research.

It should be typed single line spacing, in Times New Roman with size 12 within the specified margin of the page. The total number of typed pages should not exceed 10. The use of tables, figures, equations should be absolutely minimum unless they are extremely essential. Only the essential references should appear in the text. Sections and subsections (not exactly the same as used in the main thesis) may be used to enhance the readability. Only minimal essential part of appendices and reference list should be included as part of the Research Summary.

6.2. *Submission for Evaluation*

a. The thesis and research summary should be prepared as per guidelines provided in this manual. In case of any problems, the supervisor(s) should be contacted.

b. The candidate should fill the checklist and sign the Certificate of Thesis Submission for Evaluation (Annexure VI). The Certificate should be signed and submitted in duplicate. One copy after stamping by the concerned University official with due entries will be returned to the candidate.

c. For evaluation purposes, a candidate for M. Tech degree is required to submit
   i.   Four copies of Research Summary
   ii.   Four hard copies of the thesis printed on both sides and spiral bound using flexible cover of thick white art paper. The cover page should be printed as per specifications for the title page (Annexure I).
   iii. A CD with exactly identical contents in pdf format. The candidate should ensure that the CD can be opened on any system.
   iv.   A plagiarism report of the thesis having similarity index less than 20%.
   v.   Reprint of published research papers/acceptance letters.
   vi.   Fee receipts.

d. For evaluation purposes, a candidate for M. Tech. degree is required to submit

>   **i.**   Three hard copies of the thesis printed on both sides and spiral bound using flexible cover of thick white art paper. The cover page should be printed as per specifications for the title page (Section 3.2).
>
>   **ii.**   A CD with exactly identical contents in pdf format. The candidate should ensure that the CD can be opened on any system.
>
>   **iii.**   Institute Permission for submission of thesis.
>
>   **iv.**   A plagiarism report of the thesis having similarity index less than 20%.

6.3.   *Final Submission*

After the successful completion of viva-voce examination and with approval of the viva-voce board, the candidate should finalize the thesis incorporating all the suggestions made during the evaluation process by the internal and external examiners and the suggestions emerging during viva-voce examination including modifications in the title of the thesis.

Following should then be submitted:

a. Certificate of Final Thesis Submission (Annexure VII) signed by the candidate and the supervisor(s) certifying that all the corrections suggested by the examiners have been incorporated, the thesis has been prepared as per guidelines, due credit to other researchers have been appropriately accorded and no part of the thesis is copied from any other source.

b. The final thesis should be printed on both sides on good quality white paper not less than 80gsm and hard bound as per specifications given in Annexure VIII, IX, and X, as applicable. The cover page should be printed as per specifications for the title page (Annexure I) except that it will include month and year of final submission.

c. Colour Code: The colour code for the thesis will be as follows:

>   **i.**   **M. Tech.** - bound with hard cover not less than 120 gsm with **light blue** with impressions printed in **black** colour. The side back of the thesis should also carry the title, name of candidate and month and year of final submission (Annexure VIII).

d. For electronic repository of the University, a CD with exactly identical contents as the final thesis in pdf format should also be submitted. The candidate should ensure that the CD can be opened on any system. The CD should carry the name, enrollment number and program of the candidate.

e. **Number of copies** (incorporating all corrections including viva-voce examination)

M.Tech Two copies printed on both sides and hard bound as per university specifications plus a CD with thesis contents in pdf format.

Note: The candidate must submit the required **certificates** at the time of both the submissions (a) for evaluation and (b) final after viva-voce examination for provisional degree certificate.

7. SIZE OF THESIS

There is no rigid restriction on the size of the thesis. However, for Ph.D., it should not generally exceed 300 pages of the typed matter beginning from the first page of Chapter 1 to the last page of the last Appendix. Similarly, for M.Tech., it should not generally exceed around 150 pages.

8. REFERENCES

For knowing more about the styles and presentation, the following few references should be followed:

Journal Research Papers:

a. Nintanavongsa, Prusayon, Ufuk Muncuk, David Richard Lewis, and Kaushik Roy Chowdhury. "Design optimization and implementation for RF energy harvesting circuits." *IEEE Journal on emerging and selected topics in circuits and systems* 2, no. 1 (2012): 24-33.

b. Lee, Hoon, Sang-Rim Lee, Kyoung-Jae Lee, Han-Bae Kong, and Inkyu Lee. "Optimal beamforming designs for wireless information and power transfer in MISO interference channels." *IEEE Transactions on Wireless Communications* 14, no. 9 (2015): 4810-4821.

c. Mo, Jeonghoon, Hoi-Sheung Wilson So, and Jean Walrand. "Comparison of multichannel MAC protocols." *IEEE Transactions on mobile computing* 7, no. 1 (2008): 50-65.

Magazines:

1. Candès, Emmanuel J., and Michael B. Wakin. "An introduction to compressive sampling [a sensing/sampling paradigm that goes against the common knowledge in data acquisition]." *IEEE signal processing magazine* 25, no. 2(2008): 21-30.

2. Leaves, Paul, Klaus Moessner, Rahim Tafazolli, David Grandblaise, Didier Bourse, Ralf Tonjes, and Michele Breveglieri. "Dynamic spectrum allocation in composite reconfigurable wireless networks." *IEEE Communications Magazine* 42, no. 5 (2004): 72-81.

3. Demestichas, Panagiotis, Guillaume Vivier, Karim El-Khazen, and M. Theologou. "Evolution in wireless systems management concepts: from composite radio environments to reconfigurability." *IEEE Communications Magazine* 42, no. 5 (2004): 90-98.

Conference Papers:

1 Clancy, T. Charles. "Achievable capacity under the interference temperature model." In *IEEE INFOCOM 2007-26th IEEE International Conference on Computer Communications*, pp. 794-802. IEEE, 2007.
2 Pandharipande, Ashish, and J-PMG Linnartz. "Performance analysis of primary user detection in a multiple antenna cognitive radio." In *2007 IEEE International Conference on Communications*, pp. 6482-6486. IEEE, 2007.
3 Zheng, Haitao, and Chunyi Peng. "Collaboration and fairness in opportunistic spectrum access." In *IEEE International Conference on Communications, 2005. ICC 2005. 2005*, vol. 5, pp. 3132-3136. IEEE, 2005.

Symposium Papers:

1 Buddhikot, Milind M., Paul Kolodzy, Scott Miller, Kevin Ryan, and JasonEvans. "DIMSUMnet: new directions in wireless networking using coordinated dynamic spectrum." In *Sixth IEEE International Symposium on a World of Wireless Mobile and Multimedia Networks*, pp. 78-85. IEEE, 2005.
2 Pérez-Romero, Jordi, Oriol Sallent, Ramón Agustí, and Lorenza Giupponi. "A novel on-demand cognitive pilot channel enabling dynamic spectrum allocation." In *2007 2nd IEEE international symposium on new frontiers in dynamic spectrum access networks*, pp. 46-54. IEEE, 2007.
3 Raman, Chandra sekharan, Roy D. Yates, and Narayan B. Mandayam. "Scheduling variable rate links via a spectrum server." In *First IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks, 2005. DySPAN 2005*, pp. 110-118. IEEE, 2005.

Workshop Papers:

1. Mitola Iii, Joseph. "Cognitive radio for flexible mobile multimedia communications." *Mobile Networks and Applications* 6, no. 5 (2001): 435-441.
2. Holland, Oliver, Vasilis Friderikos, and A. Hamid Aghvami. "Green spectrum management for mobile operators." In *2010 IEEE Globecom Workshops*, pp. 1458-1463. IEEE, 2010.
3. Cabric, Danijela, Artem Tkachenko, and Robert W. Brodersen. "Experimental study of spectrum sensing based on energy detection and network cooperation." In *Proceedings of the first international workshop on Technology and policy for accessing spectrum*, p. 12. ACM, 2006.

Books:

1. Marsch, Patrick, and Gerhard P. Fettweis, eds. *Coordinated Multi-Point in Mobile Communications: from theory to practice*. Cambridge University Press, 2011.
2. Xiao, Yang, and Fei Hu, eds. *Cognitive radio networks*. CRC press, 2008.
3. Caso, Giuseppe, Mai T. Phuong Le, Luca De Nardis, and Maria-Gabriella Di Benedetto. "Non-cooperative and cooperative spectrum sensing in 5G cognitive networks." *Handbook of Cognitive Radio* (2017): 1-21.

Book Chapter:

a. Karygiannis, Tom, and Les Owens. "Wireless network security." *NIST special publication* 800 (2002): 48.
b. Frankel, Sheila, Bernard Eydt, Les Owens, and Karen Scarfone. "Establishing wireless robust security networks: a guide to IEEE 802.11 i." *National Institute of Standards and Technology* (2007).
c. Karygiannis, Tom, and Les Owens. "Wireless network security." *NIST special publication* 800 (2002): 48.

Thesis:

1. Mitola III, Joseph. "Cognitive radio: an integrated agent architecture for software radio." *Royal Institute of Technology (KTH)* (2000).
2. Lehtomaki, Janne. "Analysis of energy based signal detection." *Ph. D. Thesis, University of Oulu* (2005).
3. Luo, Chenchi. "Non-uniform sampling: algorithms and architectures." PhD diss., Georgia Institute of Technology, (2012).

Dissertation:

1. J. Mitola, "Cognitive radio: An integrated agent architecture for software defined radio," Ph.D. dissertation, KTH Royal Inst. of Technol., Stockholm, Sweden, 2000.
2. Sharma, Shree Krishna. "Interweave/underlay cognitive radio techniques and applications in satellite communication systems." PhD diss., University of Luxembourg, Luxembourg, 2014.
3. Duarte, Melissa. "Full-duplex wireless: Design, implementation and characterization." PhD diss., Rice University, 2012.

Report:

1. Force, FCC Spectrum Policy Task. "Report of the spectrum efficiency working group." *http://www. fcc. gov/sptf/files/SEWGFinalReport_1. pdf* (2002).
2. DARPA, ATO. "Next Generation (XG) Program."
http://www.darpa.mil/ato/programs/xg/
index.htm.
3. Mobile VCE. Green Radio, Aug. (2015).
[Online]. Available: http://www.mobilevce.com/green-radio

Licentiate Proposal:

1. J. Mitola, "Cognitive Radio." Licentiate proposal, KTH, Stockholm, Sweden.

TITLE OF THESIS

A Thesis Submitted
In Partial Fulfillment of the Requirements
for the Degree of

Master of Technology
in

FIELD OF SPECIALIZATION

by

NAME OF STUDENT

(Enrollment No.)

Under the Supervision of

Dr. NAME OF SUPERVISOR

Institution

to the

FACULTY OF …………………

Noida Institute of Engineering and Technology

(An Autonomous Institute)

<u>DECLARATION</u>

I hereby declare that the work presented in this report entitled "THESIS TITLE", was carried out by me. I have not submitted the matter embodied in this report for the award of any other degree or diploma of any other University or Institute. I have given due credit to the original authors/sources for all the words, ideas, diagrams, graphics, computer programs, experiments, results, that are not my original contribution. I have used quotation marks to identify verbatim sentences and given credit to the original authors/sources.

I affirm that no portion of my work is plagiarized, and the experiments and results reported in the report are not manipulated. In the event of a complaint of plagiarism and the manipulation of the experiments and results, I shall be fully responsible and answerable.

Name   :

Enroll. No.   :

Field   :

(Candidate Signature)

<u>DECLARATION</u>

I hereby declare that the work presented in this report entitled "THESIS TITLE", was carried out by me. I have not submitted the matter embodied in this report for the award of any other degree or diploma of any other University or Institute.

I have given due credit to the original authors/sources for all the words, ideas, diagrams, graphics, computer programs, experiments, results, that are not my original contribution. I have used quotation marks to identify verbatim sentences and given credit to the original authors/sources.

I affirm that no portion of my work is plagiarized, and the experiments and results reported in the report are not manipulated. In the event of a complaint of plagiarism and the manipulation of the experiments and results, I shall be fully responsible and answerable.

Name   :

Roll. No.   :

Branch   :

(Candidate Signature)

CERTIFICATE

Certified that **Name of student (**enrollment no…..) has carried out the research work presented in this thesis entitled **"Title of Thesis……………."** for the award of **Master of Technology** (print only that is applicable) from Noida Institute of Engineering and Technology under my/our (print only that is applicable) supervision. The thesis embodies results of original work, and studies are carried out by the student himself/herself (print only that is applicable) and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

Signature   Signature

(Name of Supervisor)   (Name of Supervisor)

(Designation)   (Designation)

(Address)   (Address)

Date:

Note: In case of only one supervisor, the sole supervisor will sign on the right side and the details on the left will not be printed. In case of three supervisors, the third one along with his/her name, designation, address will sign in the centre of the page underneath the details of the two other supervisors. The date, however, will be common to all.

TABLE OFCONTENTS

(Signature of the Candidate)

Name:………………..…………………….

Enrollment No.: ………………………….

CERTIFICATE OF THESIS SUBMISSION FOR EVALUATION

(Submit in Duplicate)

1. Name: …………………………………………………………………….……………….

2. Enrollment No.: …………………………………………………………..

3. Thesis title: …………………………………………………………….…………..

4. Degree for which the thesis is submitted: ………………………………………………

5. Faculty of the University to which the thesis is submitted:

6. Thesis preparation guideline was referred to for preparing the thesis. ☐ YES   ☐ NO

7. Specifications regarding thesis format have been closely followed. ☐ YES   ☐ NO

8. The contents of the thesis have been organized based on the guidelines.   ☐ YES   ☐ NO

9. The thesis has been prepared without resorting to plagiarism.   ☐ YES   ☐ NO

10. All sources used have been cited appropriately.   ☐ YES   ☐ NO

11. The thesis has not been submitted elsewhere for a degree.   ☐ YES   ☐ NO

12. Submitted four spirals bound copies plus one CD.   ☐ YES   ☐ NO

(Signature of the Candidate)

Name:………………..…………………….

Enrollment No.: ………………………….

CERTIFICATE OF FINAL THESIS SUBMISSION

(To be submitted in duplicate)

1. Name: ………………………………………………………………..…………...

2. Enrollment No.: ………………………………………………………………....

3. Thesis title: ………………………………………………………………...…

4. Degree for which the thesis is submitted: …………………………………………….

5. Faculty (of the University to which the thesis is submitted): …………………………………

6. Thesis preparation guideline was referred to for preparing the thesis. ☐ YES ☐ NO

7. Specifications regarding thesis format have been closely followed. ☐ YES ☐ NO

8. The contents of the thesis have been organized based on the guidelines. ☐ YES NO

9. The thesis has been prepared without resorting to plagiarism. ☐ YES ☐ NO

10. All sources used have been cited appropriately. ☐ YES ☐ NO

11. The thesis has not been submitted elsewhere for a degree. ☐ YES ☐ NO

12. All the corrections have been incorporated ☐ YES ☐ NO

13. Submitted two hard bound copies plus one CD. ☐ YES ☐ NO

(Signature (s) of the Supervisor (s))

 Name(s):……………..…………………….

(Signature of Candidate)

 Name:……………..………………

 Enrollment No.:……………………

TITLE OF THESIS

**A Thesis Submitted
In Partial Fulfillment of the Requirements
for the Degree of**

MASTER OF TECHNOLOGY

in

FIELD OF SPECIALIZATION

by

NAME OF STUDENT

(Enrollment No.)

Under the Supervision of

Dr. NAME OF SUPERVISOR

Institution

to the

FACULTY OF …………………

Noida Institute of Engineering and Technology

(An Autonomous Institute)

Month, Year