NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to

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

Evaluation Scheme & Syllabus

For

Master of Technology in Artificial Intelligence (AI) First Year

(Effective from the Session: 2021-22)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute)

M. TECH (AI)

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/

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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M. TECH (AI)

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	AMTAI0201	Machine Learning	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	AMTAI0251	Machine Learning Lab	0	0	4				20		30	50	2
7	AMTCSE0252	Robotic Process Automation Lab	0	0	4				20		30	50	2
8	AMTAI0253	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/

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

S.No.	**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	Credits
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 Hours

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 Hours

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, 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 Hours

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 Hours

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 Hours

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		
6. John R.Hubbard, "Data Structures with Java", Pearson Education, 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=22https://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	Credits
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, Queensproblem, 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 knowledge-based 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 00**	**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

M. TECH FIRST YEAR			
Course Code	**AMTCSE0151**	**L T P**	**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.	K2,3
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. TECHFIRST 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 Arduino and Raspberry Pi	8 Hours

Arduino platform boards anatomy, arduino IDE, coding, using emulator, using libraries, additions in arduino, programming the arduino 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	K3, K2

	protocols and data dissemination.	
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**	**Credits**
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	Credits
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	Credits
Course Title	Advanced Security of Networked Systems	3 0 0	3

Course objective:

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 Hours**

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 Hours**

Malware - Virus Infection Techniques, Anatomy of a Virus, Virus Propagation,Classification ofViruses 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 Hours**

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

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

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 Hours**

DNS – DNS Zones, Zone Transfer, BIND, DNS Spoofing, DNS Cache Poisoning, IPSec – Introduction, Tunnel & Transfer Modes, IPSec Authentication Header, EncapsulatingSecurity 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 RoutingFirewalls – 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**
	DATA ANALYTICS: Introduction to Streaming Data Analytics,	

UNIT-V	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	Credits
Course Title	Pattern Recognition	3 0 0	3

Course objectives:

The course facilitates 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 playersin 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	Credits
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	Credits
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 is 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, 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	**8**

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
2. 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	Credits
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 networks Security architecture for open distributed systems, Undergraduate level knowledge of computer systems and networks.

Course Contents / Syllabus

UNIT-I	Introduction to Mobile Security	8 Hours

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 Hours

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

UNIT-III	Security in Smart Phones	8 Hours

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 Hours

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 Hours

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 components	K2
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.

3. 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, Behavioral 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 Management component, Data Managementcomponent, Resource Managementcomponent, Inter sub-system communication, Object Design process

UNIT-IV		8

Object Oriented Analysis : Iterative Development, Unified process & UP Phases, Inception,

Elaboration,Construction Transition, Understandingrequirements, 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/

M. TECH FIRST YEAR

Course Code	AMTAI0201	L T P	Credit
Course Title	Machine Learning	3 0 0	3

Course objectives:

This course covers the basic concepts and techniques of Machine Learning including the implementation of machine learning for solving practical problems.

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

INTRODUCTION- Learning, Types of Learning, well defined learning problems, designing a Learning System, History of ML, Introduction of Machine Learning Approaches, THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias, Tools used in ML and Data Science Vs Machine Learning

UNIT-II	Regression, Decision Tree & Instance based learning	8 hours

Regression, Application of Regression in Machine Learning.

DECISION TREE LEARNING - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning.

INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.

UNIT-III	Bayesian Learning, Support Vector Machine	8 hours

BAYESIAN LEARNING - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm.

SUPPORT VECTOR MACHINE: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM

UNIT-IV	Neural Network	8 hours

NEURAL NETWORK- Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. various learning techniques; perception and convergence rule, Hebb Learning

UNIT-V	Reinforcement Learning & Genetic Algorithms	8 hours

REINFORCEMENT LEARNING–Introduction to Reinforcement Learning, Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning – Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning.

GENETIC ALGORITHMS: Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications.

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

CO 1	Understand the need for machine learning for problem solving.	K2

CO 2	Explain the concept of learning used in machine learning.	K2
CO 3	Use of machine learning algorithms for the classification and regression problems.	K3
CO 4	Differentiate the use of Supervised and Unsupervised learning.	K4
CO 5	Analyze the various tools used for the application of machine learning.	K4

Text books

1. Tom M. Mitchell, Machine Learning, First edition, 1997, McGraw Hill Education
2. AndriyBurkov, The Hundred-Page Machine Learning Book, 2019, First edition, Notion Press

Reference books

1. Toby Segaran, Programming Collective Intelligence: Building Smart Web 2.0 Applications, 2007, First Edition,O'Reilly Media.
2. Drew Conway and John Myles White, Machine Learning for Hackers: Case Studies and Algorithms to Get you Started, 2012, First Edition, O'Reilly Media.
3. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2009, Second Edition, Springer.

NPTEL/ Youtube/ Faculty Video Link:

https://nptel.ac.in/courses/106/106/106106198/

https://nptel.ac.in/courses/111/107/111107137/

https://nptel.ac.in/courses/106/106/106106202/

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

https://nptel.ac.in/courses/106/105/106105152/

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

MetaBots: -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	**AMTAI0251**	**L T P**	**Credit**
Course Title	**Machine Learning Lab**	**0 0 4**	**2**

Suggested list of Experiments

Sr. No.	Name of Experiment	CO
1.	Write a program to perform various types of regression	CO1
2.	Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO1, CO2, CO3
3.	Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	CO2
4.	Implement naïve Bayesian Classifier model. Write the program to calculate the accuracy, precision, and recall for your data set.	CO1,CO2
5.	Apply EM algorithm to cluster a set of data. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.	CO1, CO2
6.	Implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.	CO4
7.	Implement Support Vector Machine using Scikit-learn	CO5
8.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO5

Lab Course Outcomes: After completion of this course students will be able to–

CO 1	Understand the implementation of ML Tool.	K2
CO 2	Design python programs for various learning algorithms.	K6
CO 3	Apply appropriate data sets to the machine learning algorithms.	K3
CO 4	Identify and apply machine learning algorithms to solve real world problems.	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	Credit
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 Counterpropagation Net, Forward only Counter propagation 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=PLZoTAELRMXVPGU70ZGsckrMdr0FteeRUi
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 ScopeDocument, 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 through different types of reviews.	K2
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	K_4, 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 Mangement "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 behavior, 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 experience and some familiarity with 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 Conceptsand 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 technology can be used to innovate and improve business processes. The course covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions 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 Cryptocurrency 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,	**8**

	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	

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 enhancement and 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 Processing, 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, multidata base 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. 2Computer Forensics and Cyber Crime: An Introduction (3rd Edition) by Marjie T. Britz, 2013.

Reference Books

3. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
4. 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.
5. Computer Forensics: Hard Disk and Operating Systems, EC Council, September 17, 2009
6. Computer Forensics Investigation Procedures and response, EC-Council Press, 2010
7. Digital Evidence and Computer Crime, Third Edition: Forensic Science, Computers, and the Internet by Eoghan Casey, 2011

NPTEL/ Youtube/ Faculty Video Link:

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	Familiarize 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 recognize and analyze 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	**8 hours**

	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	
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 applying Intrusion 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, Tensor Board, Modularity, Sharing Variables, Keras, Perceptrons: What is a Perceptron, XOR Gate example.

UNIT-II	Neural Networks	8 hours

Activation Functions: Sigmoid, ReLU, Hyperbolic Fuctions, 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

M. TECH FIRST YEAR

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 ArchitectureandOrganization,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 phishing, 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, Confinementprinciple, 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	**8**

	marks, Dynamic watermarking. Software Similarity Analysis: - Alternate methods for defeating obfuscations. K-gram basedanalysis, API-Based analysis, Tree-based Analysis, Graph-Based analysis, Metrics-BasedAnalysis	
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 operatingsystem-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