



Syllabus: *M. Tech. in Computer Science and Engineering (Artificial Intelligence)*

<b>M. Tech. in Computer Science and Engineering in Artificial Intelligence</b>					
<b>Semester - I</b>					
<b>Code</b>	<b>Course Title</b>	<b>Hours per week</b>			<b>Credits</b>
		<b>L</b>	<b>T</b>	<b>P</b>	
RCC-PCT-MCSAI-101	<b>Program Core I -</b> Analysis of Algorithms	3	0	0	3
RCC-PCT-MCSAI-102	<b>Program Core II-</b> Artificial Intelligence	3	0	0	3
RCC-PET-MCSAI-101	<b>Program Elective I –</b> [A] Image Processing [B] Natural Language Processing	3	0	0	3
RCC-PET-MCSAI-102	<b>Program Elective II –</b> [A] Cloud Computing [B] Data Mining	3	0	0	3
RCC-PCL-MCSAI-191	<b>Laboratory I –</b> Artificial Intelligence Lab	0	0	4	2
RCC-PEL-MCSAI-192	<b>Laboratory II –</b> [A] Image Processing Lab [B] Natural Language Processing Lab	0	0	4	2
RCC-PROJ-MCSAI-181	<b>Project I –</b> Research Methodology and IPR	2	0	0	2
RCC-AU-MCSAI-181	Research Paper Writing using LATEX	2	0	0	0
<b>Total</b>		16	0	8	18
<b>Semester - II</b>					
<b>Code</b>	<b>Course Title</b>	<b>Hours per week</b>			<b>Credits</b>
		<b>L</b>	<b>T</b>	<b>P</b>	
RCC-PCT-MCSAI-201	<b>Program Core III –</b> Machine Learning	3	0	0	3
RCC-PCT-MCSAI-202	<b>Program Core IV –</b> Data Science & Visualization	3	0	0	3
RCC-PET-MCSAI-201	<b>Program Elective III –</b> [A] IoT and Edge Computing [B] Optimization Techniques	3	0	0	3



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RCC-PET-MCSAI-202	<b>Program Elective IV –</b> [A] Soft Computing [B] Audio Video Processing	3	0	0	3
RCC-PCL-MCSAI-291	<b>Laboratory III –</b> Machine Learning Lab	0	0	4	2
RCC-PEL-MCSAI-292	<b>Laboratory IV –</b> [A] IoT and Edge Computing Lab [B] Optimization Techniques Lab	0	0	4	2
RCC-PROJ-MCSAI-281	<b>Project II–</b> Minor Project and Seminar	0	0	4	2
RCC-AU-MCSAI-281	Pedagogical Practices in Teaching	2	0	0	0
<b>Total</b>		14	0	12	18
<b>Semester - III</b>					
Code	Course Title	Hours per week			Credits
		L	T	P	
RCC-PET-MCSAI-301	<b>Program Elective V –</b> [A] Computer Vision and Robotics [B] Big Data Analytics	3	0	0	3
RCC-PGOET(CSE-AI)301	<b>Open Elective I –</b> [A] Project Management and Entrepreneurship [B] Cognitive Science	3	0	0	3
RCC-PROJ-MCSAI-381	<b>Project III –</b> Industrial Training – Project - Seminar	0	0	8	4
RCC-PROJ-MCSAI-382	<b>Project IV –</b> Dissertation I (Final year project) - Seminar	0	0	12	6
<b>Total</b>		6	0	20	16
<b>Semester - IV</b>					
Code	Course Title	Hours per week			Credits
		L	T	P	
RCC-PROJ-MCSAI-481	<b>Project V –</b> Dissertation II: Defense of Dissertation	0	0	20	10
RCC-PROJ-MCSAI-482	<b>Project VI –</b> Comprehensive Viva	0	0	12	6
<b>Total</b>		0	0	0	16



## 1<sup>st</sup> Year-1<sup>st</sup> Semester

<b>Course Name</b>	Analysis of Algorithms	<b>Course Code</b>	RCC-PCT-MCSAI-101
<b>Semester</b>	1 <sup>st</sup> Years, 1 <sup>st</sup> Semester	<b>Program Name</b>	M.Tech CSE(AI)
<b>L:T:P</b>	3:0:0	<b>Total Hours</b>	36 Hrs.

**Course Pre-requisite:** Ability of Problem Solving.

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PCT-MCSAI-101.CO1	<b>Compare</b> between different data structures.	Analyzing (Level VI)
RCC-PCT-MCSAI-101.CO2	<b>Identify</b> the familiarity with major algorithms and data structures with their representations.	Applying (Level III)
RCC-PCT-MCSAI-101.CO3	<b>Analyze</b> the complexity of algorithms based on asymptotic notation and justify the correctness of algorithms.	Analyzing (Level VI)
RCC-PCT-MCSAI-101.CO4	<b>Identify</b> the design technique used in an algorithm.	Applying (Level III)
RCC-PCT-MCSAI-101.CO5	<b>Interpret</b> the different algorithm design paradigm approaches for a given problem.	Evaluating (Level V)
RCC-PCT-MCSAI-101.CO6	<b>Identify</b> the limits of algorithms and the ways to cope with the limitations.	Applying (Level III)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	<b>INTRODUCTION:</b> Types of Data structures: Array, Linked List, Stack, Queue, Tree, and Graph. Algorithms: Fundamentals of Algorithmic Problem Solving, pseudo code for expressing algorithms. <b>Analysis of Algorithm Efficiency:</b> Analysis Framework, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation. <b>Brute Force:</b> Array: Bubble Sort, Selection Sort, Graph: Depth-First Search and Breadth-First Search.	6	CO1, CO2, CO3
2	<b>DIVIDE AND CONQUER:</b> Merge Sort, Quick Sort, Binary Search, Binary Tree Traversals, Master Theorem. <b>Decrease-and-Conquer:</b> Insertion Sort, Topological Sorting. <b>Transform-and-Conquer:</b> Heap Sort, AVL Trees, 2-3 Trees and B Trees.	6	CO3
3	<b>GREEDY METHOD:</b> Fractional knapsack problem, Minimum cost spanning trees, Single source shortest path problem, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	6	CO4
4	<b>DYNAMIC PROGRAMMING:</b> 0/1 knapsack problem, Single source shortest path algorithm Dijkstra algorithm, Bellman-Ford algorithm, All pairs shortest path problem Floyd-warshall algorithm, Travelling sales person problem.	8	CO5
5	<b>BACKTRACKING:</b> N-queen problem, Graph colouring.	4	CO5



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	<b>BRANCH AND BOUND:</b> Travelling sales person problem.		
6	<b>NP-HARD AND NP-COMPLETE PROBLEMS:</b> Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem.	6	CO6

**Text Books:**

1. Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi
2. Gajendra Sharma, Design & Analysis of Algorithms, Khanna Publishing House, Delhi
3. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.

**Web-Resource:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_cs47/preview](https://onlinecourses.nptel.ac.in/noc19_cs47/preview)



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<b>Course Name</b>	Artificial Intelligence	<b>Course Code</b>	RCC-PCT-MCSAI-102
<b>Semester</b>	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	<b>Program Name</b>	M.Tech CSE(AI)
<b>L:T:P</b>	3:0:0	<b>Total Hours</b>	36 Hrs.

**Course Pre-requisite:** Data Structures and Algorithms, Probability theory.

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PCT-MCSAI-102.CO1	<b>Understand</b> the foundational concepts of Artificial Intelligence, including AI techniques and problems.	Understanding (Level II)
RCC-PCT-MCSAI-102.CO2	<b>Explain</b> the structure and types of intelligent agents and environments, and the various approaches to solving problems in AI.	Understanding (Level II)
RCC-PCT-MCSAI-102.CO3	<b>Apply</b> different uninformed and informed search algorithms to solve AI problems.	Applying (Level III)
RCC-PCT-MCSAI-102.CO4	<b>Analyze</b> adversarial search techniques to make decisions in games and other problem-solving scenarios.	Analyzing (Level IV)
RCC-PCT-MCSAI-102.CO5	<b>Apply</b> probabilistic reasoning (Dempster-Shafer theory, fuzzy logic) and planning techniques (goal stack, hierarchical) to design efficient problem-solving systems.	Applying (Level III)
RCC-PCT-MCSAI-102.CO6	<b>Explain</b> the principles of natural language processing and learning techniques, including neural networks and expert systems.	Understanding (Level II)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	<b>Introduction [4L]:</b> Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. <b>Intelligent Agents [4L]:</b> Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. <b>Problem Solving [4L] :</b> Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	12	CO1, CO2
2	<b>Search techniques :</b> <b>Uninformed Search Techniques [5L]:</b> Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. <b>Heuristic search strategies[5L]:</b> Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. <b>Adversarial search[3L]:</b> Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	13	CO3, CO4
3	<b>Probabilistic Reasoning and Planning System :</b> <b>Probabilistic Reasoning[2L]:</b> Dempster-Shafer theory, Fuzzy sets & fuzzy logics. <b>Planning [3L]:</b> Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	5	CO5



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4	<b>Learning:</b> Introduction to machine learning paradigms: unsupervised, supervised, reinforcement learning, Neural Net learning, Genetic Learning, Inductive Learning, Decision tree learning.	2	CO6
5	<b>Expert Systems:</b> Representing and using domain knowledge, expert system shells, and knowledge acquisition.	2	CO6
6	<b>Application Topics:</b> Introduction to NLP including Sentiment detection from text, AI in Social Networks.	2	CO6

**Text Books:**

1. Artificial Intelligence Concept and Applications by Lavika Goel, Wiley publication, First Edition 2021, Reprint 2024
2. Artificial Intelligence Making A System Intelligence by Dr. Nilakshi Jain, Wiley publication, First Edition, 2019, Reprint: 2023
3. Artificial Intelligence, Ritch & Knight, TMH, 3<sup>rd</sup> Edition

**Reference Books:**

1. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI

**Web-Resource:**

1. <https://nptel.ac.in/courses/106102220>
2. <https://archive.nptel.ac.in/courses/112/103/112103280/>



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<b>Course Name</b>	Image Processing	<b>Course Code</b>	RCC-PET-MCSAI-101(A)
<b>Semester</b>	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	<b>Program Name</b>	M.Tech CSE(AI)
<b>L:T:P</b>	3:0:0	<b>Total Hours</b>	36

**Course Pre-requisite:** Data structure, 2D matrix, Array.

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PET-MCSAI-101(A).CO1	<b>Compare Different types and images and its representation in 2D.</b>	Analyzing (Level IV)
RCC-PET-MCSAI-101(A).CO2	<b>Apply</b> linear point operations such as additive image offset and multiplicative scaling to adjust the brightness and contrast of images for various applications.	Applying (Level III)
RCC-PET-MCSAI-101(A).CO3	<b>Evaluate</b> the effectiveness of smoothing techniques (e.g., low-pass filters) and sharpening techniques (e.g., high-pass filters) in enhancing specific image features or suppressing noise.	Evaluating (Level V)
RCC-PET-MCSAI-101(A).CO4	<b>Apply</b> Prewitt, Sobel, and Laplacian operators to identify edges and transitions in digital images to enhance edge details.	Applying (Level III)
RCC-PET-MCSAI-101(A).CO5	<b>Differentiate</b> between texture features such as contrast, auto-correlation, entropy, and inverse difference method, understanding their relevance in characterizing textures.	Analyzing (Level IV)
RCC-PET-MCSAI-101(A).CO6	<b>Evaluate</b> the effectiveness of different thresholding methods (global, optimal) for specific applications in terms of segmentation accuracy.	Evaluating (Level V)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	<b>Machine Vision [5L]</b> Image and Pictures, Processing and Analysis of Image, Application of Image processing, Digital Image Representation, Types of digital images, Image Acquisition.	5	CO1
2	<b>Gray Level Image Processing [7L]</b> Image Histogram, Linear Point Operations, Additive Image offset, Multiplicative Image Scaling, Image Negative, Histogram Stretching, Nonlinear point operations, Logarithmic Point Operations, Histogram Equalization.	7	CO2
3	<b>Image Enhancement and Filtering [8L]</b> Spatial Domain Method, Frequency Domain Method, Contrast Enhancement, Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	CO3
4	<b>Edge Detection [6L]</b> Differences and Edges, Prewitt Operator, Sobel Operator, Laplacian operator, Zero Crossing, Edge enhancement, High boost filtering, Canny's Edge Detection, Human Psychovisual Phenomenon in Edge Detection.	6	CO4
5	<b>Image Feature and Texture [4L]</b> Low level Feature, High Level Feature, Texture classification,	4	CO5



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	Gray-Level Cooccurrence Matrix, Angular Second Method, Contrast Feature, Auto-Correlation, Entropy, Inverse Difference Method, Model-Based Methods for Texture analysis.		
6	<b>Image Segmentation</b> [6L] Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation – Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	6	CO6

**Text Books:**

1. Digital Image Processing, Gonzalves, Pearson.
2. Digital Image Processing, Jahne, Springer India.
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI.
4. Fundamentals of Digital Image Processing, Jain, PHI.
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS.



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<b>Course Name</b>	Natural Language Processing	<b>Course Code</b>	RCC-PET-MCSAI-101(B)
<b>Semester</b>	1	<b>Program Name</b>	M.Tech CSE(AI)
<b>L:T:P</b>	3:0:0	<b>Total Hours</b>	36

**Course Pre-requisite:** Data Structures and Algorithms, Probability theory, Basic python programming, Linear Algebra

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PET-MCSAI-101(B).CO1	<b>Understand</b> basic NLP concepts, terminology, and techniques, including tokenization, stemming, and lemmatization, to demonstrate knowledge of text processing fundamentals.	Level II Understand
RCC-PET-MCSAI-101(B).CO2	<b>Remember</b> and describe key NLP algorithms and models, such as n-grams, TF-IDF, Word2Vec, and BERT, while distinguishing between different approaches to language representation.	Level I Remember
RCC-PET-MCSAI-101(B).CO3	<b>Apply</b> machine learning techniques (e.g., Naive Bayes, SVM) to classify text and perform sentiment analysis on given datasets, demonstrating practical use of these methods in NLP tasks.	Level III Apply
RCC-PET-MCSAI-101(B).CO4	<b>Analyze</b> the performance of NLP models (like HMMs, CRFs, and RNNs) in sequence labeling tasks, and compare their strengths and limitations in handling different types of language data.	Level IV Analyzing
RCC-PET-MCSAI-101(B).CO5	<b>Evaluate</b> deep learning models (LSTM, GRU, Transformer) for complex NLP applications such as text summarization and machine translation, by assessing their accuracy and efficiency.	Level IV Evaluate
RCC-PET-MCSAI-101(B).CO6	<b>Create</b> an end-to-end NLP application (e.g., a chatbot, NER system, or sentiment analysis tool) using modern NLP libraries and pre-trained models, while addressing real-world challenges.	Level VI Create

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	<b>Introduction to NLP and Text Processing:</b> Introduction to NLP – Overview, Applications, Challenges, Text Processing Basics – Tokenization, Lemmatization, Stemming, Regular Expressions in NLP, Text Normalization – Lowercasing, Stop words, Punctuation, Sentence Segmentation and Word Segmentation.	6	CO1
2	<b>Language Models and Text Representation :</b> Bag of Words (BoW), Term Frequency, and TF-IDF, Word Embeddings – Introduction to Word2Vec, Pre-trained Word Embeddings – GloVe, Fast Text, Language Models – n-Grams, Smoothing Techniques, Advanced Language Models – Perplexity, Entropy.	6	CO1, CO2
3	<b>Syntax and Parsing :</b> Part-of-Speech (POS) Tagging – Rule-based, Stochastic Methods, POS Tagging with Hidden Markov Models (HMMs), Syntactic Parsing – Dependency Parsing, Syntactic Parsing – Constituency Parsing, Context-	6	CO4



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	Free Grammars (CFGs).		
4	<b>Semantics and Meaning :</b> Semantic Analysis – Word Sense Disambiguation, Named Entity Recognition (NER), Semantic Role Labeling, Distributional Semantics – Vector Space Models.	4	CO1, CO3
5	<b>Machine Learning for NLP :</b> Text Classification – Naive Bayes, SVM, Sequence Labeling – HMMs, Conditional Random Fields (CRFs), Topic Modeling – Latent Dirichlet Allocation (LDA), Supervised vs Unsupervised Learning for NLP.	4	CO3
6	<b>Deep Learning for NLP :</b> Introduction to Neural Networks for NLP, Recurrent Neural Networks (RNNs) for Sequential Data, LSTMs and GRUs, Attention Mechanisms in NLP, Transformer Networks – Architecture Overview, Pre-trained Models – BERT, GPT, T5	6	CO5
7	<b>NLP Applications :</b> Text Generation – RNN-based Approaches, Neural Machine Translation (NMT), Text Summarization – Extractive vs Abstractive, Sentiment Analysis and Opinion Mining.	4	CO6

**Text Books:**

1. T1: Speech and Language Processing, Jurafsky and Martin, Pearson Education, 3<sup>rd</sup> Edition
2. T2: Foundation of Statistical Natural Language Processing, Manning and Schütze, MIT Press, 1<sup>st</sup> Edition

**Reference Books:**

1. R1 : Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.



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<b>Course Name</b>	Cloud Computing	<b>Course Code</b>	RCC-PET-MCSAI-102(A)
<b>Semester</b>	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	<b>Program Name</b>	M.TECH CSE(AI)
<b>L:T:P</b>	3:0:0	<b>Total Hours</b>	36

**Course Pre-requisite:** NA

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PET-MCSAI-102(A).CO1	<b>Understand</b> the basic concepts, key technologies, strengths and limitations of cloud computing	Understanding (Level II)
RCC-PET-MCSAI-102(A).CO2	<b>Demonstrate</b> the service and delivery models of cloud computing	Applying (Level III)
RCC-PET-MCSAI-102(A).CO3	<b>Explain</b> suitable virtualization concept	Understanding (Level II)
RCC-PET-MCSAI-102(A).CO4	<b>Understand</b> the service oriented architecture of cloud	Understanding (Level II)
RCC-PET-MCSAI-102(A).CO5	<b>Demonstrate</b> the components of Google web, AWS and Microsoft cloud services	Applying (Level III)
RCC-PET-MCSAI-102(A).CO6	<b>Identify</b> security, privacy and interoperability issues of cloud computing	Applying (Level III)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	Distributed Computing and Basics of Cloud Computing: Overview of Distributed Computing, Cluster computing, Grid computing. [2L] Introduction to Cloud Computing, NIST model for cloud computing - Cloud issues and challenges. Characteristics, Benefits and Advantages of Cloud Computing. [4L]	6	CO1
2	Cloud Service and Deployment Models : Deployment Models (Public, Private, Hybrid and Community Clouds). [4L] Service Models – IaaS, PaaS, SaaS, Anything as a service (XaaS). [2L]	6	CO2
3	Virtualization Techniques: Types of virtualization (access, application, CPU, storage) [2L]. Load Balancing and Virtualization: Basic Concepts, Load balancing algorithm- static and dynamic. [2L] Hypervisors: Virtual machine technology and types, VMware Sphere. [2L]	6	CO3
4	Cloud Computing Architecture: Cloud Computing Architecture Requirements, Cloud computing architecture. [2L] Service Oriented Architecture – Basics, Terminologies, Components, Standards and Technologies, Benefits and Challenges. [2L] Cloud Simulator. [2L]	6	CO4
5	Web Services and Service Level Agreement: Amazon Web Services, Google Web Services, Microsoft Cloud Services. Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing. Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS. [6L] Service Level Agreement (SLA) aspects and requirements. [2L]	8	CO5



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6	Security Issues in Cloud Computing: Cloud Access: authentication, authorization and accounting - Cloud Reliability and fault-tolerance. [2L] Cloud Security, privacy policy and compliance, Interoperability, Identity and Access Management, Quality of services. [2L]	4	CO6
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**Text Books:**

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2011.
2. Cloud Computing Black Book by Kailash Jayaswal (Author), Jagannath Kallakurchi (Author), Donald J. Houde (Author), Deven Shah (Author), Kogent Learning Solutions (Author), January 2014
3. Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition - Pearson, 2024

**Reference Books:**

1. Cloud Computing, Michael Miller, Pearson, 2008

**Web-Resource:**

1. [aws.amazon.com](https://aws.amazon.com)
2. [cloud.google.com](https://cloud.google.com)



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Course Name	Advanced Data Mining	Course Code	RCC-PET-MCSAI-102(B)
Semester	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	Program Name	M. Tech CSE(AI)
L:T:P	3:0:0	Total Hours	40

Course Pre-requisite: DBMS, Data Mining, Data Processing.

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-PET-MCSAI-102(B).CO1	<b>Understand</b> different domains of Data Mining task.	Understanding (Level I)
RCC-PET-MCSAI-102(B).CO2	<b>Analyze</b> the mining algorithms to mine from different types of datasets.	Analyzing (Level VI)
RCC-PET-MCSAI-102(B).CO3	<b>Knowledge</b> on how one algorithm can be changed to mine from different sources of data.	Evaluating (Level V)
RCC-PET-MCSAI-102(B).CO4	<b>Understand</b> current advanced algorithms for mining data.	Developing (Level I)
RCC-PET-MCSAI-102(B).CO5	<b>Understand</b> the complexity of mining massive data with distributed data mining.	Understanding (Level I)
RCC-PET-MCSAI-102(B).CO6	<b>Use</b> state-of-the-art techniques for social network analysis from intelligence data.	Developing (Level III)

Detailed Syllabus:

Module #	Contents	Contact Hours	CO Linked
1	<b>Introduction:</b> Data Mining, KDD, Challenges, Data Mining Tasks, Data Pre-processing, Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Data Transformation.	4	CO1
2	<b>Association Rules:</b> Problem Definition, Frequent Itemsets mining, Infrequent itemsets mining, Rare Itemsets mining, Apriori Principle, Support and Confidence Measures, Association Rule Generation, Apriori Algorithm, Eclat Algorithms, FP-Growth Algorithms.	8	CO2
3	<b>Sequential Pattern Mining:</b> Sequential Pattern Mining concepts, primitives, scalable methods; Transactional Patterns and other temporal based frequent patterns, Mining Time series Data.	4	CO2
4.	<b>Stream Data Mining:</b> Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams.	6	CO3
5.	<b>Class Imbalance Problem and Graph Mining:</b> Class Imbalance Problem; Graph Mining, Mining frequent sub graphs.	4	CO4
6.	<b>Web Mining:</b> Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web.	6	CO4
7.	<b>Distributed Data Mining:</b> Distributed Data Mining, Distribute data mining framework, Distributed data source, Distributed data mining techniques, distributed association rule mining and Challenges of distributed data mining; Social Network Analysis, characteristics of social Networks.	8	CO5, CO6



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**Text Books:**

1. Jiawei Han and M Kamber , “Data Mining Concepts and Techniques, , Second Edition, Elsevier Publication, 2011”.
2. G Dong and J Pei, “Sequence Data Mining, Springer, 2007”.
3. Vipin Kumar, “Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006”.
4. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012
5. Arun K. Pujari,” Data Mining Techniques, Universities Press, 2001”.

**Web-Resource:**

1. <https://onlinecourses.nptel.ac.in>
2. Research Paper.



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<b>Course Name</b>	Artificial Intelligence Lab	<b>Course Code</b>	RCC-PCL-MCSAI-191
<b>Semester</b>	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	<b>Program Name</b>	M. Tech CSE(AI)
<b>L:T:P</b>	0:0:3	<b>Total Hours</b>	24

**Course Pre-requisite: Programming Language, Artificial intelligence**

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PCL-MCSAI-191.CO1	<b>Apply</b> programming logic in simple Python programs.	Applying (Level III)
RCC-PCL-MCSAI-191.CO2	<b>Implement</b> programs in Python using conditionals and loops for solving problems.	Applying (Level III)
RCC-PCL-MCSAI-191.CO3	<b>Deploy</b> functions to decompose a Python program.	Applying (Level III)
RCC-PCL-MCSAI-191.CO4	<b>Implement</b> algorithmic solutions to simple computational problems	Applying (Level III)
RCC-PCL-MCSAI-191.CO5	<b>Utilize</b> Python packages in developing software applications.	Creating (Level VI)
RCC-PCL-MCSAI-191.CO6	<b>Develop</b> algorithm to intelligent system	Creating (Level VI)

**Detailed Syllabus:**

Module #	Module Name	Experiment Topics	No of Labs Required	CO Linked
1	Data Structures in Python:	Python Data Types, Numbers, Variable, and Strings Indexing and Slicing with Strings, Indexing and Slicing with Strings, Print Formatting with Strings	1	CO1
2	List in Python, Dictionaries, Tuples, Sets, Booleans, Python Objects and Data Structures, Python Comparison Operators, Chaining Comparison	Tuples List Dictionaries, Python Objects Python Comparison Operators	1	CO1
3	Python Statements and Functions	If Elif and Else Statements in Python, For Loops , While Loops, Useful operators, List Comprehensions Functions, Function Arguments	2	CO2, CO3
4	OOP & Python ecosystem for machine learning	Class Keyword, Class object Attributes and Methods. Inheritance, Polymorphism	1	CO4
5	NumPy, Scipy, Pandas, Matplotlib	NumPy, Scipy, Pandas, Matplotlib	1	CO5
6	Biological foundations to intelligent systems	Artificial neural networks Back-propagation networks Recurrent networks	2	CO6

**Text Books:**

1. Introduction to Computing and Problem Solving with Python, Jeeva Jose, Khanna Book Publishing Company, Delhi.
2. Learning Python, Mark Lutz, O'Reilly Media

**Reference Books:**

1. Learn Python the Hard Way, Zed Shaw, Addison-Wesley



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2. Python for Data Analysis, Wes McKinney, O'Reilly

**Web-Resource:**

1. <https://www.w3schools.com/python/>
2. <https://www.geeksforgeeks.org/python-programming-language-tutorial/>



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Course Name	Image Processing Lab	Course Code	RCC-PEL-MCSAI-192(A)
Semester	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	Program Name	M.Tech CSE(AI)
L:T:P	0:0:3	Total Hours	24

Course Pre-requisite: Data structure, Basics of Python

Course Outcome (CO)

CO Number	Statement	Knowledge Level
RCC-PEL-MCSAI-192(A).CO1	<b>Convert</b> image data into matrix form to basic matrix operations to modify pixel values (e.g., adjusting brightness or contrast)..	Applying (Level III)
RCC-PEL-MCSAI-192(A).CO2	<b>Apply</b> image cropping, resizing, and rotation operations using image processing tools	Applying (Level III)
RCC-PEL-MCSAI-192(A).CO3	<b>Implement</b> linear point operations such as adding a constant value to pixel intensities for brightness control and scaling pixel intensities to enhance or reduce contrast in an image.	Applying (Level III)
RCC-PEL-MCSAI-192(A).CO4	<b>Implement</b> low-pass filtering (for image smoothing) and high-pass filtering (for image sharpening) in the frequency domain, transforming images using Fourier transforms and corresponding filters.	Applying (Level III)
RCC-PEL-MCSAI-192(A).CO5	<b>Apply</b> the Canny edge detection operator to identify edges in various images.	Applying (Level III)
RCC-PEL-MCSAI-192(A).CO6	<b>Create</b> real-time object detection applications using the YOLO model,	Creating (Level VI)

Detailed Syllabus:

Module #	Module Name	Experiment Topics	No of Labs Required	CO Linked
1	Machine Vision	<b>1:</b> Representation of images in matrix form. <b>2:</b> Read and save images in different formats. (JPEG, PNG, TIFF).	1	CO1
2	Color Image Processing	<b>3:</b> Convert color images to grayscale and binary formats. <b>4:</b> Apply basic operations such as cropping, resizing, and rotation on images.	1	CO2
3	Gray Level Image Processing	<b>5:</b> Plot and analyze the histogram of an image. <b>6:</b> Implement linear point operations such as additive image offset and multiplicative image scaling.	1	CO3
4	Image Enhancement and Filtering	<b>7:</b> Apply contrast enhancement techniques in the spatial domain. <b>8:</b> Implement frequency domain filtering techniques: low-pass and high-pass filtering.	2	CO4



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5	Edge Detection	<b>9:</b> Apply Canny operators to detect edges in images. <b>10:</b> Implement Laplacian edge detection and detect zero-crossing points.	1	CO5
6	Image Segmentation	<b>11:</b> Perform simple global thresholding and optimal thresholding on grayscale images for segmentation. <b>12: Object Detection using YOLO model.</b>	2	CO6

**Text Books:**

1. Digital Image Processing, Gonzalves, Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI



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Course Name	Research Methodology and IPR	Course Code	RCC-PROJ-MCSAI-181
Semester	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	Program Name	M.Tech CSE(AI)
L:T:P	2:0:0	Total Hours	24

**Course Pre-requisite:** Basic knowledge of project work and project work

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-PROJ-MCSAI-181.CO1	<b>Understand</b> research problem formulation.	Understanding (Level II)
RCC-PROJ-MCSAI-181.CO2	<b>Analyze</b> research related information	Analyzing (Level IV)
RCC-PROJ-MCSAI-181.CO3	<b>Follow</b> research ethics	Applying (Level III)
RCC-PROJ-MCSAI-181.CO4	<b>Identify</b> different types of intellectual property and their relevance in innovation and business contexts.	Applying (Level III)
RCC-PROJ-MCSAI-181.CO5	<b>Analyze</b> the legal framework and processes related to different IPRs	Analyzing (Level IV)
RCC-PROJ-MCSAI-181.CO6	<b>Evaluate</b> strategies for IP management, commercialization, and protection, including the Plant Variety Act and layout design of integrated circuits.	Evaluating (Level V)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	4	CO1
2	Effective literature studies approaches, analysis Plagiarism, Research ethics,	4	CO2
3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, Referencing style and bibliography, a presentation and assessment by a review committee	4	CO3
4	<b>Introduction to Intellectual Property:</b> Definition and Concept of Intellectual Property (IP); Types of Intellectual Property: Patents, Trademarks, Copyright, Trade Secrets, Industrial Design, Geographical Indications, Overview of International IPR Laws and Treaties, Importance of IPR in Business and Innovation, IPR and its Role in Economic Development	4	CO4
5	<b>Patents, Copyrights, Trademarks, and Other Forms of IP:</b> Detailed Overview of Patents: Application Process, Patentability Criteria, Patent Infringement; Copyright: Authorship, Registration, and Protection; Trademarks: Branding, Registration, and Infringement; Geographical Indication: Importance, Registration, and Legal Protection; Industrial Design: Concept, Registration, and Protection; Trade Secrets: Legal Framework and Protection; Case Studies: Patent, Copyright, Trademark, Industrial Design, and GI Disputes	4	CO5



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6	<b>IP Management, Plant Variety Act, and Commercialization:</b> Plant Variety Protection and Farmers' Rights Act: Scope and Legal Framework; Layout Designs of Integrated Circuits: Overview and Protection; IP Asset Management: Valuation and Licensing of IP; Technology Transfer and Commercialization of IP; Enforcement of IPR and Remedies for Infringement; Case Studies on IP Commercialization and Plant Variety Act Challenges	4	CO6
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**Text Books:**

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

**Reference Books:**

1. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008
2. Narayanan, P. (2007). Intellectual property law (4th ed.). Eastern Law House.

**Web-Resource:**

1. NPTEL: Research Methodology By Prof. Edamana Prasad, Prof. Prathap Haridoss | IIT Madras. Link: [https://onlinecourses.nptel.ac.in/noc23\\_ge36/preview](https://onlinecourses.nptel.ac.in/noc23_ge36/preview)
1. NPTEL: Intellectual Property, By Prof. Feroz Ali | IIT Madras



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<b>Course Name</b>	Research Paper Writing Using LaTeX	<b>Course Code</b>	RCC-AU-MCSAI-181
<b>Semester</b>	1 <sup>st</sup> Year, 1 <sup>st</sup> Semester	<b>Program Name</b>	M. Tech CSE(AI)
<b>L:T:P</b>	2:0:0	<b>Total Hours</b>	24

**Course Pre-requisite:** Programming Language

**Course Outcome (CO)**

CO Number	Statement	Knowledge Level
RCC-AU-MCSAI-181.CO1	Identify the basic components of LaTeX and articulate its advantages for research writing.	Understanding (Level II)
RCC-AU-MCSAI-181.CO2	Apply formatting techniques to create well-structured LaTeX documents.	Applying (Level III)
RCC-AU-MCSAI-181.CO3	Analyze and incorporate figures, tables, and mathematical expressions into LaTeX documents effectively.	Analyzing (Level IV)
RCC-AU-MCSAI-181.CO4	Utilize bibliographic management tools to effectively manage citations and references in LaTeX documents.	Applying (Level III)
RCC-AU-MCSAI-181.CO5	Evaluate and implement advanced LaTeX features to enhance the presentation and organization of research papers.	Evaluating (Level V)
RCC-AU-MCSAI-181.CO6	Create a complete, polished research paper in LaTeX ready for submission, following academic standards and best practices.	Creating (Level VI)

**Detailed Syllabus:**

Module #	Contents	Contact Hours	CO Linked
1	<b>Introduction to LaTeX:</b> Overview of LaTeX and its advantages for academic writing Installation and setup of LaTeX distribution (TeX Live, MikTeX) Basic document structure (document class, preamble, body) Compiling and troubleshooting LaTeX documents	4	CO1
2	<b>Document Structure and Formatting:</b> Organizing documents: sections, subsections, and paragraph formatting Customizing page layout and margins Setting up headers and footers Working with fonts, typography, and styles	4	CO2
3	<b>Figures, Tables, and Mathematical Expressions:</b> Inserting and formatting figures (images, plots) Creating and customizing tables Writing and formatting mathematical equations Utilizing packages for enhanced graphical and mathematical formatting (amsmath, graphicx)	6	CO3
4	<b>References and Citations:</b> Introduction to bibliographic management tools (BibTeX, BibLaTeX) Creating and managing a bibliography In-text citations and reference styles Advanced referencing techniques	2	CO4
5	<b>Advanced LaTeX Features:</b> Using templates and class files for specific journals Creating appendices and glossaries Implementing cross-referencing and indexing Working with LaTeX packages to extend functionality	4	CO5
6	<b>Finalizing and Submitting Research Papers:</b>	4	CO6



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	Proofreading techniques and error checking in LaTeX documents Generating PDFs and preparing for submission Understanding and adhering to journal submission guidelines Best practices for collaborative writing and version control in LaTeX		
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**Text Books:**

3. Guide to LATEX, H Kopka, 2004.

**Web-Resource:**

3. [https://www.overleaf.com/learn/latex/Learn\\_LaTeX\\_in\\_30\\_minutes](https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes)