

टिपणी

पदव्युत्तर उपयोजित परमाणू विद्युत विभाग
संत गाडगे बाबा अमरावती विद्यापीठ
क्र.संगाबा अवि/५०२/१६०/२०२६
दि.१६.०५.२०२६

विषय:- M.Tech (Artificial Intelligence & Data Science) या अभ्यासक्रमाची Scheme व Syllabus विद्यापीठ संकेतस्थळावर प्रसिध्द करण्याकरीता पाठविण्याबाबत...

पदव्युत्तर उपयोजित पमराणू विद्युत विभागातील M.Tech (Artificial Intelligence & Data Science) या अभ्यासक्रमाची Scheme व Syllabus विद्यापीठ संकेतस्थळावर प्रसिध्द करावयाची आहे. सोबत M.Tech (Artificial Intelligence & Data Science) या अभ्यासक्रमाची Scheme व Syllabus जोडून पाठविण्यात येत आहे.

तेव्हा आपणास नम्र विनंती करण्यात येते कि, या विभागातील अभ्यासक्रमाची Scheme व Syllabus विद्यापीठ संकेतस्थळावर प्रसिध्द करण्यात यावा.

Srinkele

प्राध्यापक व विभाग प्रमुख
पदव्युत्तर उपयोजित परमाणू विद्युत विभाग
Department of Applied Electronics
Sant Gadge Baba Amravati University
Amravati.

प्रति,

प्रमुख (संगणक केंद्र)
संत गाडगे बाबा अमरावती विद्यापीठ
अमरावती

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

DEPARTMENT OF APPLIED ELECTRONICS

Faculty: Science and Technology (Engineering)

Programme: **M. Tech. (Artificial Intelligence and Data Science)**

Program Educational Objectives (PEOs)

After successful completion of the programme, students would be able to

1. Build strong foundations in Artificial Intelligence and Data Science, so that they can contribute substantially in the area of research and innovation.
2. Develop highly competent professionals in the field of AI and Data Science to keep abreast of the latest trends and techniques.
3. Emerge as professionals and entrepreneurs to design and develop solutions for real world interdisciplinary problems having positive societal impacts.

Graduate Attributes prescribed by NBA for M-Tech Program

GA1: Scholarship of Knowledge

Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.

GA2: Critical Thinking

Analyse complex engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

GA3: Problem Solving

Think laterally and originally, conceptualise and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

GA4: Research Skill

Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

GA5: Usage of modern tools

Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

GA6: Collaborative and Multidisciplinary work

Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

GA7: Project Management and Finance

Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

GA8: Communication

Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

GA9: Life-long Learning

Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

GA10: Ethical Practices and Social Responsibility

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

GA11: Independent and Reflective Learning

Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

The POs formulated for M. Tech. (AI and DS) are consistent with the NBA's Graduate Attributes (PG).

PROGRAMME OUTCOMES (POs)

Programme Outcomes: On successful completion of the programme, student would be able to:

PO1	Deep subject Knowledge and intellectual breadth (GA1)	Develop extensive knowledge in various areas of Artificial Intelligence and Data Science
PO2	Professional Ethics (GA10)	Apply ethical principles and commit to professional ethics and responsibilities and norms of the standard practices.
PO3	Creative & Critical Thinking (GA2)	Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO4	Innovation, Research and Problem Solving (GA3, GA4)	Identify, formulate, review research literature, and analyse problems using the first principles of mathematics and engineering sciences. Apply the knowledge of mathematics, science, engineering fundamentals, Artificial Intelligence and Data Science to the solution of real-world problems. Design solutions for intelligent systems, system modules or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. Demonstrate the knowledge of, and need for sustainable development.
PO5	Team work and Communication Skills (GA6, GA8)	Function effectively as an individual, and as a member or leader in diverse teams, and in collaborative -multidisciplinary scientific research settings. Present/communicate research at national/international level, write effective articles, reports and design documentation, make effective presentations, and give and receive clear instructions. Communicate disciplinary knowledge to the community and broader public.
PO6	Professionalism and Leadership Readiness (GA6, GA7)	Demonstrate personal accountability and effective work habits, e.g., punctuality, working productively with others, and time as well as workload management. Use the strengths of others to achieve common goals
PO7	Lifelong learning (GA9)	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PO8	Competence for Digital World (GA5)	Prepare well for living, learning and working in a Digital Society; Choose and apply appropriate modern tools/frameworks / platforms /instruments, software simulators, techniques, resources, and modern engineering and ICT tools to complex activities with an understanding of the limitations. Use existing digital technologies ethically and efficiently to solve problems, complete tasks, and accomplish goals.
PO9	Global Citizenship (GA10)	Act with an informed awareness of global issues. Engage in initiatives that encourage equity and growth for all.
PO10	Project Management and Finance (GA7)	Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO11	Independent and Reflective Learning (GA11)	Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After successful completion of the M. Tech. (AI and DS) programme, students would be able to:

1. Develop solutions to real world problems in the diverse emerging areas
2. Systematically investigate and provide Artificial Intelligence and Data Science based solutions in multidisciplinary domains

Sant Gadge Baba Amravati University Amravati
Scheme of Teaching, Learning & Examination leading to the Degree Master of Technology (AI and DS)(Two Years- Four Semesters PG Programme) (M. Tech. Part-I) Semester- I

S. N.	Course Number/ Code	Subject/Course	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme						
			Scheme of Studies Per Week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	L/T	Practical	Total		Theory		Practical		Total Marks	Marks	Grade
											Paper	Internal Assessment	Internal	External			
1	1MTAIDS1	Program Core I- Machine Learning	3	0	0	3	3	-	3	3	80	20			100	50	P
2	1MTAIDS 2	Program Core II- Advanced Data Structures and practices	3	0	0	3	3	-	3	3	80	20			100	50	P
3	1MTAIDS 3x	Program Elective I- Pattern Recognition/Digital Image Processing/Data Science/Data Preparation and Analysis	3	0	0	3	3	-	3	3	80	20			100	50	P
4	1MTAIDS 4x	Programme Elective II- Advances in Artificial Intelligence/Natural Language Processing/Speech Processing and applications/Big Data Analysis	3	0	0	3	3	-	3	3	80	20			100	50	P
5	1MTAIDS5	Research Methodology and IPR	2	0	0	2	2	-	2	3	80	20			100	50	P
6	1MTAIDS 6x	Audit Course English for Research Paper Writing/Disaster Management/Sanskrit for Technical Knowledge/Value Education	2	0	0	0	0	0	0			50			50	25	P
7	1MTAIDS7	Laboratory 1 (Based on Machine Learning)	0	0	4	4	-	2	2	3			25	25	50	25	P
8	1MTAIDS8x	Laboratory 2 (Based on Program Elective- I)	0	0	4	4	-	2	2	3			25	25	50	25	P
9		#Internship @															
	TOTAL					22			18						650		

L: Lecture, T: Tutorial, P: Practical

Students may complete their Internship in First OR Second OR Third Semester of M. Tech.. (AI and DS) according to their convenience; @ denotes Ancillary Credit

Note : *Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester breaks, cumulatively.

Internship (During vacations of Semester I to Semester III cumulatively) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of Semester I to III. This will carry 2 Credits for learning of 60 hours or 3 Credits for learning of 90 hours. Students will undergo internal evaluation (based on the report submitted, seminar presentation and viva-voce, etc.) by the assigned teacher from the department/college during the fourth semester, so that credits earned as applicable and grades obtained will be reflected in final semester IV credit grade report

Sant Gadge Baba Amravati University Amravati
Scheme of Teaching, Learning & Examination leading to the Degree Master of Technology (AI and DS)(Two Years- Four Semesters PG Programme) (M. Tech. Part-I) Semester- II

S. N.	Course Number/ Code	Subject/Course	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme						
			Scheme of Studies Per Week				Credits				Maximum Marks				Minimum Passing		
			L	T	P	Total	L/T	Practical	Total		Theory		Practical		Total Marks	Marks	Grade
							Paper	Internal Assessment	Internal	External							
1	2MTAIDS 1	Programme Core III – Deep Learning	3	0	0	3	3	-	3	3	80	20			100	50	P
2	2 MTAIDS 2	Programme Core IV –Computer Vision	3	0	0	3	3	-	3	3	80	20			100	50	P
3	2 MTAIDS 3x	Programme Elective III – Genetic Algorithms and applications/Text Processing/Data Visualization/ Advanced Data Mining	3	0	0	3	3	-	3	3	80	20			100	50	P
4	2 MTAIDS 4x	Programme Elective IV – Augmented Reality and Virtual Reality/Real time autonomous systems/Internet of Things/Neuromorphic Cognitive systems	3	0	0	3	3	-	3	3	80	20			100	50	P
5	2MTAIDS 5x	Audit Course: Constitution of India/Pedagogy Studies/Stress Management by Yoga/Personality Development through Life Enlightenment Skills.	2	0	0	0	0	-	0			50			50	25	P
6	2 MTAIDS 6	Laboratory 3 (Based on Deep Learning with TensorFlow)	0	0	4	4	0	2	2	3			25	25	50	25	P
7	2 MTAIDS 7x	Laboratory 4 (Based on Program Elective-III)	0	0	4	4	0	2	2	3			25	25	50	25	P
8	2 MTAIDS 8	Mini Project with Seminar	2	0	0	2	2	0	2	3			25	25	50	25	P
9		#Internship @															
	TOTAL					24			18						600		

L: Lecture, T: Tutorial, P: Practical

Students may complete their Internship in First OR Second OR Third Semester of M. Tech.. (AI and DS) according to their convenience; @ denotes Ancillary Credit

Note : *Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester breaks, cumulatively.

Internship (During vacations of Semester I to Semester III cumulatively) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of Semester I to III. This will carry 2 Credits for learning of 60 hours or 3 Credits for learning of 90 hours. Students will undergo internal evaluation (based on the report submitted, seminar presentation and viva-voce, etc.) by the assigned teacher from the department/college during the fourth semester, so that credits earned as applicable and grades obtained will be reflected in final semester IV credit grade report

Sant Gadge Baba Amravati University Amravati
Scheme of Teaching, Learning & Examination leading to the Degree Master of Technology (AI and DS) (Two Years- Four Semesters PG Programme) (M. Tech. Part-II) Semester- III

S. N.	Course Number/Code	Subject/Course	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme						
			Scheme of Studies Per Week				Credits				Maximum Marks			Minimum Passing			
			L	T	P	Total	L/T	Practical	Total	Paper	Internal Assessment	Internal	External	Total Marks	Marks	Grade	
1	3 MTAIDS 1x	*Programme Elective V – Cognitive Robotics/Swarm Intelligence/Human Machine Interfaces/Edge and Fog Computing	3	0	0	3	3	-	3	3	80	20			100	50	P
2	3 MTAIDS 2x	Open Elective (any one From MOOCs SWAYAM) Expert Systems Blockchain Social Network Analysis Business Analytics Stream analytics Industry 4.0 Operations Research Cost Management of Engineering Projects Composite Materials Waste to Energy Any other Course as approved by the Department/College	3	0	0	3	3	-	3	3	80	20			100	50	P
3	3 MTAIDS 3	Dissertation-I /Industrial Project	0	0	20	20	0	10	10	3			100	100	200	100	P
4		#Internship @															
	TOTAL					26			16						400		

L: Lecture, T: Tutorial, P: Practical

Students may complete their Internship in First OR Second OR Third Semester of M. Tech.. (AI and DS) according to their convenience; @ denotes Ancillary Credit

Note : *Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester breaks, cumulatively.

Internship (During vacations of Semester I to Semester III cumulatively) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of Semester I to III. This will carry 2 Credits for learning of 60 hours or 3 Credits for learning of 90 hours. Students will undergo internal evaluation (based on the report submitted, seminar presentation and viva-voce, etc.) by the assigned teacher from the department/college during the fourth semester, so that credits earned as applicable and grades obtained will be reflected in final semester IV credit grade report

*Students going for Industrial Project/Thesis will complete these courses through MOOCs as per the AICTE guidelines.

Sant Gadge Baba Amravati University Amravati
Scheme of Teaching, Learning & Examination leading to the Degree Master of Technology (AI and DS)(Two Years- Four Semesters PG Programme) (M. Tech. Part-II) Semester- IV

S. N.	Course Number/Code	Subject/Course	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme						
			Scheme of Studies Per Week				Credits				Maximum Marks				Minimum Passing		
			L	T	P	Total	L/T	Practical	Total		Theory		Practical		Total Marks	Marks	Grade
											Paper	Internal Assessment	Internal	External			
1	4MTAIDS1	Dissertation II	0	0	32	32	0	16	16	3			100	200	300	150	P
2	4 MTAIDS 2	#Internship @											50		50	25	P
	TOTAL					32			16						350		

L: Lecture, T: Tutorial, P: Practical

Students may complete their Internship in First OR Second OR Third Semester of M. Tech.. (AI and DS) according to their convenience; @ denotes Ancillary Credit

Note : *Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester breaks, cumulatively.

Internship (During vacations of Semester I to Semester III cumulatively) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of Semester I to III. This will carry 2 Credits for learning of 60 hours or 3 Credits for learning of 90 hours. Students will undergo internal evaluation (based on the report submitted, seminar presentation and viva-voce, etc.) by the assigned teacher from the department/college during the fourth semester, so that credits earned as applicable and grades obtained will be reflected in final semester IV credit grade report

PROGRAMME SCHEME FOR M.TECH. (AI AND DS) SEM-I.

Course Number	Subject	Scheme Of Studies Per Week			Credits
		L	T	P	
1MTAIDS1	Program Core I- Machine Learning	3	0	0	3
1 MTAIDS 2	Program Core II- Advanced Data Structures and practices	3	0	0	3
1 MTAIDS 3x	Program Elective I- Pattern Recognition/Digital Image Processing/Data Science/Data Preparation and Analysis	3	0	0	3
1 MTAIDS 4x	Programme Elective II- Advances in Artificial Intelligence/Natural Language Processing/Speech Processing and applications/Big Data Analysis	3	0	0	3
1MTAIDS5	Research Methodology and IPR	2	0	0	2
1MTAIDS 6x	Audit Course English for Research Paper Writing/Disaster Management/Sanskrit for Technical Knowledge/Value Education	2	0	0	0
1MTAIDS7	Laboratory 1 (Based on Machine Learning)	0	0	4	2
1MTAIDS8x	Laboratory 2 (Based on Program Elective- I)	0	0	4	2
Total Credits: 18					

M.TECH. (AI AND DS) SEM- II

Course Number	Subject	Scheme Of Studies Per Week			Credits
		L	T	P	
2 MTAIDS 1	Programme Core III – Deep Learning	3	0	0	3
2 MTAIDS 2	Programme Core IV – Computer Vision	3	0	0	3
2 MTAIDS 3x	Programme Elective III –Genetic Algorithms and applications/Text Processing/Data Visualization/Advanced Data Mining	3	0	0	3
2 MTAIDS 4x	Programme Elective IV –Augmented Reality and Virtual Reality/Real time autonomous systems/Internet of Things/Neuromorphic Cognitive systems	3	0	0	3
2MTAIDS 5x	Audit Course Constitution of India/Pedagogy Studies/Stress Management by Yoga/Personality Development through Life Enlightenment Skills.	2	0	0	0
2 MTAIDS 6	Laboratory 3 (Based on Deep Learning with TensorFlow)	0	0	4	2
2 MTAIDS 7x	Laboratory 4 (Based on Program Elective-III)	0	0	4	2
2 MTAIDS 8	Mini Project with Seminar	2	0	0	2
Total Credits: 18					

*Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.

M.TECH. (AI AND DS) III SEM*

Course No.	Subject	Scheme of Studies PeriodsPer Week			Credits
		L	T	P	
3 MTAIDS 1x	*Programme Elective V – Cognitive Robotics/Swarm Intelligence/Human Machine Interfaces/Edge and Fog Computing	3	0	0	03
3 MTAIDS 2x	Open Elective (any one From MOOCs SWAYAM) Expert Systems Blockchain Social Network Analysis Business Analytics Stream analytics Industry 4.0 Operations Research Cost Management of Engineering Projects Composite Materials Waste to Energy Any other Course as approved by the Department/College	3	0	0	03
3 MTAIDS 3	Dissertation-I /Industrial Project	0	0	20	10
Total Credits 16					

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.

M.TECH. (AI AND DS) SEM-IV

Course No.	Subject	Scheme of Studies Per Week			Credits
		L	T	P	
4MTAIDS1	Dissertation II	0	0	32	16
Total Credits: 16					

The Programme offers several elective courses, focusing on different aspects of AI and Data Science. A student can opt any course from the Programme Elective List.

DEPARTMENT OF APPLIED ELECTRONICS
M. Tech. (Artificial Intelligence and Data Science)

M.TECH. (AI AND DS) SEM-I.

1 MTAIDS 1 Program Core I- Machine Learning

COURSE OUTCOMES

After completion of course, students would be able to:

1. Identify and Extract features that can be used for a particular machine learning approach in various IOT applications.
2. compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. analyse mathematically various machine learning approaches and paradigms.

Unit I:

Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Nave Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models

Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class/Structured Outputs, Ranking 10

Unit II:

Unsupervised Learning

Clustering: K-means/Kernel K-means

Dimensionality Reduction: PCA and kernel PCA

Matrix Factorization and Matrix Completion

Generative Models (mixture models and latent factor models) 8

Unit III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) 7

Unit IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning 9

Unit V

Scalable Machine Learning (Online and Distributed Learning)

A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference 9

Unit VI

Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications. 5

Reference Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
4. Daniel Nedal, Python Machine Learning From Scratch, Step by Step Guide with Scikit-Learn and TensorFlow , AI Sciences Publisher
5. Alpaydin, E ,Introducation To Machine Learning,Prentice Hall,2015
6. Andriy Burkov The Hundred-Page Machine Learning Book, 2019
7. Python Machine Learning by Sebastian Raschka, Packt Publishing, 2015
8. Advanced Machine Learning with Python by John Hearty, Packt Publishing, 2016
9. Machine Learning - Algorithms, Models and Applications Edited by Jaydip Sen, IntechOpen, 2021
10. Mathematics for Machine Learning by M. P. Deisenroth, A. A. Faisal, C. S. Ong, Cambridge University Press, 2020.
11. Advanced Machine Intelligence and Signal Processing, Editors: Deepak Gupta, Koj Sambyo, Mukesh Prasad, Sonali Agarwal, Conference proceedings, Springer, 2022
12. Data Science and Machine Learning Mathematical and Statistical Methods by Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman, Chapman Hall/CRC, 2019
13. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurélien Géron, O'Reilly Media; 2e, 2019
14. Introduction to Machine Learning with Python by Andreas C. Müller and Sarah Guido, O'Reilly Media, Inc., 2017

1 MTAIDS 2 Program Core II- Advanced Data Structures and practices

COURSE OUTCOMES

After completion of course, students would be able to:

1. Implement symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Develop algorithms for text processing applications.
4. Identify suitable data structures and develop algorithms for computational geometry problems.

Unit I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in

Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing. 7

Unit II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists 5

Unit III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees 9

Unit IV

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem. 12

Unit V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees. 10

Unit VI

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem 5

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
3. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008
4. Mark Allen Weiss ,Data Structures and Algorithm Analysis in C++ , , 4 th Edition, 2014, Pearson.
5. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 3 rd Edition, 2009, The MIT Press.
6. Algorithms and Data Structures for Massive Datasets by Dzejla Medjedovic, Emin Tahirovic, and Ines Dedovic, ISBN 9781617298035, Manning, 2022

1 MTAIDS 3x Program Elective I-1MTAIDS 31 Pattern Recognition**Course Outcomes**

After successful completion of course, the student would be able to

1. Analyze the fundamental pattern recognition and machine learning theories
2. design and implement certain important pattern recognition techniques
3. apply the pattern recognition theories to applications of interest.

Unit I

Introduction to Pattern Recognition, Classifier based on Bayes decision theory 7

Unit II

Linear classifiers and nonlinear classifiers. 7

Unit III

Feature selection, feature generation using data transformation and dimensionality reduction, regional features 7

Unit IV

Template matching, Context dependent classifiers 7

Unit V

Clustering algorithms: sequential algorithm and Hierarchical Algorithms, Clustering based on functional optimization and graph theory. 8

Unit VI

Cluster algorithms based on graph theory, competitive learning algorithms, binary morphology cluster algorithm, boundary detection algorithm, kernel clustering methods, density based algorithm for large data sets, clustering algorithm on high dimensionality data sets, cluster validity 12

Text Books :

1. Pattern Recognition by Sergios Theodoridis and Konstantinos Koutroumbas, Academic Press , 4e, Elsevier Publication 2009
2. Pattern Recognition and Machine Learning ,C.M. Bishop, Springer, 2006
3. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murthy, University Press, 2015
4. Pattern Recognition: an algorithmic approach by . M. Narasimha Murthy and V. Susheela Devi, Springer, University Press, 2011

Reference Books :

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O. Duda, P.E. Hart and D.G. Stork, John Wiley, 2002
4. Pattern Recognition by Jürgen Beyerer, Matthias Richter, Matthias Nagel, Publisher: De Gruyter, Year 2017, ISBN 9783110537963
5. Essentials of Pattern Recognition: An Accessible Approach by Jianxin Wu, Cambridge University Press, 2020

1MTAIDS 32 Digital Image Processing

Course Outcomes:

After successful completion of course, the student would be able to

1. Develop an overview of the field of image processing.
2. Analyze the Image segmentation, enhancement, compression etc., approaches and how to implement them.
3. Gain experience in applying image processing algorithms to real problems
4. Analyze general terminology of digital image processing.

Unit I

Introduction, fundamental Steps in Digital Image Processing, Components of an Image processing system, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. 9

Unit II

Image Enhancement in the spatial domain: some basic gray level transformations, histogram processing, enhancement using arithmetic and logic operations, basics of spatial filters, smoothening and sharpening spatial filters, combining spatial enhancement methods. 8

Unit III

Thresholding, Edge Based Segmentation: Edge Image Thresholding, Region Based Segmentation, Matching, Representation and Description: Representation , Boundary Descriptors, Regional Descriptors. 8

Unit IV

Fundamentals of Image Compression, image compression models, elements of information theory, error-free compression, lossy compression, Image Compression Standards 8

Unit V:

Preliminaries, dilation, erosion, open and closing, hit transformation, basic morphologic algorithms 8

Unit VI: Color fundamentals, Color Models and basics of full-color image processing 7

Text Books :

1. “Digital Image Processing”, Rafael C. Gonzalez and Richard E. Woods, Fourth Edition, Pearson Education, 2018
2. Digital Image Processing”, S. Sridhar, Oxford University Press, Second Edition, 2016

Reference Books :

1. “Fundamentals of Digital Image Processing” , S. Annadurai, Pearson Edun, 2001.
2. “Digital Image Processing and Analysis”, B. Chanda and D. Dutta Majumdar, PHI, 2003.
3. “Image Processing” , Analysis and Machine Vision , Milan Sonka, Vaclav Hlavac and Roger Boyle, 2nd Edition, Thomson Learning, 2001.
4. “Digital Image Processing with MATLAB and LabVIEW” by Vipula Singh, Cengage Learning India Pvt Ltd. , 2019
5. Digital Image Processing by William Pratt, 4e, Wiley InterScience, 2007
6. Introduction to Digital Image Processing by William Pratt, 1e, CRC Press, 2013

1MTAIDS 33 Data Science

COURSE OUTCOMES

Upon successfully completing the course, the student would be able to

1. Explain how data is collected, managed and stored for data science;
2. Use the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
3. Implement data collection and management scripts using MongoDB

Unit I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. 6

Unit II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources 7

Unit III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes. 10

Unit IV

Data visualisation: Introduction, Types of data visualisation, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings. 11

Unit V

Applications of Data Science, Technologies for visualisation, Bokeh (Python) 7

Unit VI

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science. 7

Reference Books

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly. 2013
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets, Cambridge University Press, 2014
3. Data Science: Theories, Models, Algorithms, Analytics by S. R. Das, 2016
4. Foundations of Data Science by Avrim Blum, John Hopcroft, and Ravindran Kannan, Cornell, 2018
5. Statistics for Data Science by James D. Miller, , ISBN: 9781788290678, Packt Publishing 2017
6. Data Science from Scratch by Joel Grus, ISBN: 9781491901427, O’Reilly Media, Inc., 2015
7. The Kaggle Book Data analysis and machine learning for competitive data science by Konrad Banachewicz, Luca Massaron, Packt Publishing, 2022
8. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Published by John Wiley & Sons, Inc. 10475 Crosspoint Boulevard Indianapolis, Copyright © 2015 by John Wiley & Sons, Inc., Indianapolis, Indiana

1MTAIDS 34 Data Preparation and Analysis**COURSE OUTCOMES**

After completion of the course, the student would be able to

1. extract the data for performing the Analysis

Unit I	5
Data formats, parsing and transformation	7
Unit II Scalability and real-time issues, Consistency checking	
Unit III Heterogeneous and missing data, Data Transformation and segmentation	8
Unit IV Descriptive and comparative statistics, Clustering and association, Hypothesis generation	9
Unit V Designing visualizations, Time series, Geolocated data,	9
Unit VI Correlations and connections, Hierarchies and networks, interactivity	10

Text Book

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt, Wiley-Blackwell, 2006
2. Data Preparation for Data Mining by Dorian Pyle, Morgan Kaufmann Publishers, Inc, 1999

1MTAIDS 4x Program Elective II
1MTAIDS 41 Advances in Artificial Intelligence

COURSE OUTCOMES

After completion of course, students would be able to

1. Compare between optimal reasoning and human like reasoning
2. Analyze the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
3. Use different knowledge representation techniques
4. Appreciate the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

UNIT I

Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies 8

UNIT II

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Propositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining 8

UNIT III

Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks 8

UNIT IV

Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception 8

UNIT V

Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis 8

UNIT VI

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools 8

TEXT BOOK

1. Stuart Russell, Peter Norvig: “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2022

Reference Books

1. The Cambridge Handbook of Artificial Intelligence Edited by Keith Frankish William M. Ramsey, Cambridge University Press, 2014
2. Artificial Neural Networks B. Yagna Narayana, PHI, 2004
3. Neural Networks and Learning Machines by Simon Haykin, Third Edition, Pearson, 2009
4. Artificial Intelligence , 3rd Edition, E. Rich, K. Knight and S. B. Nair, Tata McGraw Hill, 2009
5. Artificial Intelligence and Expert Systems – Patterson, PHI, 1990
6. Expert Systems: Principles and Programming- Fourth Edn, Giarratano, Joseph C. and G. D. Riley, Course Technology, 2004
7. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education, 2002
8. Nils J. Nilsson, “ THE QUEST FOR ARTIFICIAL INTELLIGENCE A HISTORY OF IDEAS AND ACHIEVEMENTS”, Cambridge University Press, 2010
9. Huimin Lu and Xing Xu(Ed.), “Artificial Intelligence and Robotics”, Springer, 2018

1MTAIDS 42 Natural Language Processing

Course Outcomes

After completion of course, students would be able to

1. explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
2. Analyze approaches to syntax and semantics in NLP.
3. Use current methods for statistical approaches to machine translation.
4. Develop language modeling.
5. Identify machine learning techniques used in NLP.

UNIT I

Introduction to Natural language, 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.** 8

Unit II

Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, **Augmented Transition Networks.** 7

UNIT III

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift **Reduce Parsers, Deterministic Parsers.** 7

UNIT IV:

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory.

Language Modeling

Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling. 9

UNIT V

Introduction to Machine Translation, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status.

Anusaaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem Structure of Anusaaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusaaraka Output, Language Bridges. 9

UNIT VI

Multilingual Information Retrieval

Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources, Multilingual Automatic Summarization, Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets. 8

TEXT BOOKS:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To Practice-Daniel M. Bikel and Imed Zitouni , Pearson Publications.
3. NaturalLanguage Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India.

REFERENCE BOOKS:

1. Natural Language Processing by Jacob Eisenstein, The MIT Press, 2018
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
4. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
5. Handbook of Natural Language Processing by R. Herbrich and T. Graepel, Chapman & Hall/CRC, 2010
6. Introduction to natural language processing by R. Kibble, University of London, 2013
7. Deep Learning in Natural Language Processing by Li Deng and Yang Liu (Editors), Springer, 2018
8. Natural Language Processing with Python by Steven Bird, Ewan Klein, and Edward Loper, O'Reilly Media, Inc, 2009

1MTAIDS 43 Speech Processing and applications

Course Outcomes

After completion of course, student would be able to

1. Analyze the mechanism of human speech production and perception.
2. Learn Each component of speech recognition systems.
3. Analyze probabilistic modeling in speech recognition.
4. Build a speech recognition system.

UNIT I

Introduction to Speech processing, Basic audio processing 8

UNIT II

Human Voice, Human auditory system 7

UNIT III

Psycho acoustics, speech communications 7

UNIT IV

Audio analysis 7

UNIT V

Speech recognition 7

UNIT VI

Speech synthesis, stereo encoding, formant strengthening and steering, voice and pitch changer, statistical voice conversion, whisper to speech conversion, whisperisation , super audible speech 12

Reference Books:

1. Speech and audio processing-A Matlab based approach, Ian Vince Mcloughlin, Cambridge university press,2016
2. Digital Speech Processing: Synthesis, and Recognition by Sadaoki Furui, 2e, CRC Press, 2018
3. Speech Synthesis and Recognition by Wendy Holmes, CRC Press, 2001
4. Audio Signal Processing and Coding by Andreas Spanias, Ted Painter and Venkatraman Atti, Wiley InterScience, 2007
5. Introduction to Digital Speech Processing Lawrence R. Rabiner and Ronald W. Schafer, now Publishers Inc., 2007
6. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, by Daniel Jurafsky and James H. Martin, Third Edition, 2021.
7. Speech and Audio Processing for Coding, Enhancement and Recognition by Tokunbo Ogunfunmi • Roberto Togneri Madihally (Sim) Narasimha (Ed.), Springer, 2015

1MTAIDS 44 Big Data Analysis

Course Outcomes

After completion of course, students would be able to

1. Implement basic concepts of big data and Hadoop.
2. Analyze HDFS and Map Reduce and their working principle.
3. Create the design of HDFS with different design issues.

UNIT I

Introduction to Big Data, Analysis flow for big data, mapping analysis flow to big Data Stack 8

UNIT II

Setting of Big Data stack, Big Data patterns 8

UNIT III

Data Acquisition, Big Data storage 8

UNIT IV

Batch analysis with Hadoop 8

Unit V

Real time analysis, surveying data bases and web frames

Unit VI

Analytics algorithm , data visualization frameworks and libraries 8

Text Book:

1. Big Data Science and analytics-A hands on approach , A. Bahga, Vijay Madiseti, 2019
2. Raj Kamal, Preeti Saxena , Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, , McGraw Hill, 2018.
3. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, John Wiley & Sons, 2013

Reference Books

1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
2. Hadoop: The Definitive Guide, Tom White ,Third Edition, O' Reilly, 2012.
3. Hadoop Operations, Eric Sammer, O'Reilley, 2012.
4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O' Reilley, 2012.
5. HBase: The Definitive Guide, Lars George, O' Reilley, 2011.
6. Cassandra: The Definitive Guide, Eben Hewitt, O' Reilley, 2010.
7. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Published by John Wiley & Sons, Inc. 10475 Crosspoint Boulevard Indianapolis, Copyright © 2015 by John Wiley & Sons, Inc., Indianapolis, Indiana

1MTAIDS 5

Research Methodology and IPR

Course Outcomes:

After completion of the course, the student would be able to

1. Formulate research problem
2. Analyze research related information
3. Follow research ethics
4. Develop innovative ideas, concept, and creativity.
5. understand importance and process of creation of patents through research
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit I

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 9

Unit II

Effective literature studies approaches, analysis Plagiarism, Research ethics 7

Unit III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee 7

Unit IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. 9

Unit V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. 8

Unit VI

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs. 8

Reference 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"
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

1MTAIDS6x Audit Course**1MTAIDS61 ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)****Course outcomes:**

After completion of the course, the student would be able to

1. improve writing skills and level of readability
2. write effectively in each section
3. Understand the skills needed when writing a Title
4. Compose a good quality of paper for submission

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference Books

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

1MTAIDS 62 DISASTER MANAGEMENT (Audit Course - I & II)

Prerequisite: None

Course Outcomes:

After completion of the course, the student would be able to

1. demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches,
5. plan and programme in different countries, particularly their home country or the countries they work in

UNIT-I:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Reference Books

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" "New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

1MTAIDS 63**SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)****Course Outcomes:**

After completion of this course, students will be able to

1. Read and Write basic Sanskrit language
2. Read and Understand Ancient Sanskrit literature about science & technology
3. Appreciate Sanskrit as a logical language which will help to develop logic in students

UNIT-I:

Alphabets in Sanskrit,

UNIT-II:

Past/Present/Future Tense, Simple Sentences

UNIT-III:

Order, Introduction of roots,

UNIT-IV:

Technical information about Sanskrit Literature

UNIT-V:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Reference Books

1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

1MTAIDS 64 VALUE EDUCATION (Audit Course - I & II)**Course outcomes:**

After completion of the course, the student would be able to

1. Inculcate Knowledge of self-development
2. Closely follow the Human values
3. Develop the overall personality

UNIT-I:

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT-II:

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III:

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT-V:

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOK/ REFERENCE BOOKS

Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

1MTAIDS 7 Laboratory 1 (Based on Machine Learning)

The emphasis on understanding advanced concepts of PG course is ensured through elaborate practical work conducted through actual and virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process.

Minimum 10 experiments based on the syllabus of 1MTAIDS1: Machine Learning, that are preferably uniformly distributed over the syllabus

1MTAIDS 8 Laboratory 2 (Based on Program Elective I)

The emphasis on understanding advanced concepts of PG course is ensured through elaborate practical work conducted through actual and virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process.

Minimum 10 experiments based on the syllabus of the course chosen under Programme Elective I (1MTAIDS3X), that are preferably uniformly distributed over the syllabus

M.TECH. (AI AND DS) SEM- II**2MTAIDS 1 Programme Core III – Deep Learning****Course Outcomes:**

After Completion of the Course, the Student would be able to:

1. Learn the fundamental principles of deep learning.
2. Identify the deep learning algorithms for various types of learning tasks in various domains.
3. Implement deep learning algorithms and solve real-world problems.

UNIT - I

Fundamentals of Deep learning

8

UNIT - II

Mathematical building blocks of Neural network, Introduction to Keras, Tensor flow, setting of a deep learning workstation

8

UNIT – III

Deep learning for computer vision

8

UNIT – IV

Deep Learning for text and sequence

8

UNIT – V

Generative deep learning

8

UNIT – VI

Advanced deep learning based practices, limitations of deep learning, future of deep learning

8

Reference Books

1. Deep learning with Python , Francois Chollet, Manning Publication Compony, 2018
2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, The MIT Press, 2016
3. Dive into Deep Learning Release 1.0.0-alpha0 by Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, 2022
4. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, 2e, Springer, 2009
5. Probabilistic Graphical Models by D. Koller, and N. Friedman, MIT Press, 2016

2 MTAIDS 2 Programme Core IV – Computer Vision

Course Outcomes:

After completion of course, students would be able to:

1. Develop the practical skills necessary to build computer vision applications.
2. gain exposure to object and scene recognition and categorization from images.

Unit I:

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis 8

Unit II:

Edge detection, Edge detection performance, Hough transform, corner detection 8

Unit III:

Segmentation, Morphological filtering, Fourier transform 6

Unit IV:

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing 9

Unit V:

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi- supervised

Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods. 9

Unit VI:

Recent trends in Activity Recognition, computational photography, Biometrics. 8

Text Books:

1. Computer Vision: Algorithms and Applications 2nd Edition Richard Szeliski Final draft, September 30, 2021 © 2022 Springer
2. Dictionary of Computer Vision and Image Processing, by Fisher et al., Second Edition, Wiley, 2013
3. COMPUTER VISION A MODERN APPROACH, Second edition, David A. Forsyth and Jean Ponce Ecole Normale Supérieure, Pearson, 2012
4. Computer Vision and Image Processing Fundamentals and Applications by Manas Kamal Bhuyan, CRC Press, Taylor & Francis, 2020

Reference Book:

1. Deep Learning, by Goodfellow, Bengio, and Courville, The MIT Press, 2016

**2 MTAIDS 3x Programme Elective III –
2MTAIDS 31 Genetic Algorithms and applications**

Course Outcomes:

After completion of the course, student will be able to

1. critique the fundamental concepts of Genetic algorithms
2. Analyze the consequences of applying various genetic operators
3. analyze GA operators and implement them to solve different types of GA problems
4. Apply GA in different domains of applications

UNIT- I

Introduction to Genetic Algorithm, Mathematical foundation 8

UNIT – II

Implementation of Genetic Algorithms 8

UNIT – III

Some applications of Genetic Algorithm 8

UNIT – IV

Advanced operators and techniques in Genetic search 8

UNIT –V

Genetic based machine learning 8

UNIT VI

Applications of Genetic based machine learning 8

TEXT BOOKS

1. David E. Goldberg, “Genetic Algorithms in Search, Optimization & Machine Learning”, Pearson Education, 2001
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, “ Neural Networks, Fuzzy Logic and Genetic Algorithms “, PHI , 2003 (Chapters 8 and 9)
3. A.E. Eiben and J.E. Smith, “ Introduction to Evolutionary Computing”, Second Edition, Springer, 2015
4. S. N. Sivanandam and S. N. Deepa, “Introduction to Genetic Algorithms”, Springer, 2007

REFERENCE BOOKS

1. Kalyanmoy Deb, “Optimization for Engineering Design, algorithms and examples”, PHI 1995
2. An Introduction to Genetic Algorithm by Melanie Mitchell, The MIT Press, 1998
3. The practical handbook of genetic algorithms, applications / edited by Lance D. Chambers.— 2nd ed, Chapman and Hall/CRC, 2001

2MTAIDS 32 Text Processing

Course Outcomes:

After completion of course, student will be able to

1. Analyze various static methods of the Character wrapper class
2. Know the additional methods of the String class
3. differentiate between a String object and a String Buffer object
4. use a String Tokenizer object that extracts tokens from a string
5. perform the processing of delimited values read in from a text file

<

UNIT-I

Introduction to text mining , core text mining operations. 7

UNIT-II

Text mining preprocessing techniques, text categorization 7

UNIT-III

Text clustering: Clustering in text analysis, clustering algorithm, Information extraction, probabilistic models for information extraction 8

UNIT-IV

Preprocessing application using probabilistic and hybrid approach: Application of Hidden Markov Model (HMM) to text analysis, using MEMM for information extraction, application of conditional random fields (CRF) to text analysis, Implementation of trainable extraction grammar using SCFG rules for hybrid statistical knowledge based IE 10

UNIT-V

Presentation layer considerations for browsing query refinement , visualization approach. 7

UNIT-VI

Text mining application : General considerations, mining industry literature for business intelligence,A horizontal text mining application : patent analysis solution leveraging a commercial text analytics platform, mining biological pathway information with gene ways. 9

Text Books:

1. The text mining handbook – Advanced approaches in analysing unstructured data , R. Feldman, James Sanger, Cambridge University Press, 2007

Reference Books

2. Bran Boguraev, Ted Briscoe (Eds), “Computational Lexicography for Natural Language Processing”, Longman, 1989.
3. A V Aho, Ravi Sethi, J D Ullman, "Compilers: Principles, Techniques and Tools", Addison-Wesley.
4. Robert Sedgewick, "Algorithms in C", Addison Wesley, 1990.
5. Gerald Salton, "Automatic Text Processing", Addison-Wesley, 1989
6. Text Mining: Applications and Theory, Editor(s): Michael W. Berry, Jacob Kogan, John Wiley & Sons, Ltd, 2010
7. Text Mining From Ontology Learning to Automated Text Processing Applications, Editors: Chris Biemann, Alexander Mehler, Springer, 2014
8. Text Mining with R by Julia Silge, David Robinson, June 2017, Publisher(s): O'Reilly Media, Inc., ISBN: 9781491981658
9. Mining Text Data, Editors: Charu C. Aggarwal, Cheng Xiang Zhai, Springer, 2012