



TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

(An Autonomous Institute Affiliated to RTM Nagpur University)



DEPARTMENT OF INFORMATION TECHNOLOGY

M.Tech Artificial Intelligence & Machine Learning

Structure & Curriculum

From

Academic Year 2021-22

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management

Mission of Institute

[M1] To strive for rearing standard and stature of the students by practicing high standards of Professional ethics, transparency and accountability

[M2] To provide facilities and services to meet the challenges of Industry and Society

[M3] To facilitate socially responsive research, innovation and entrepreneurship

[M4] To ascertain holistic development of student and staff members by inculcating knowledge and profession as work practices

Vision of the Department

To contribute in the enhancement of capabilities of youth to face Information Technology challenges, by empowering them with innovative ideas.

Mission of the Department

- To stimulate students to learn effectively and apply the knowledge in the field of Engineering and Technology.
- To undertake industry academic collaboration to enhance competency in graduates.
- To foster innovative ideas amongst students for becoming leaders.
- To create an environment of research culture.
- To impart social and ethical values for inculcating the culture of lifelong learning.

Program Education Objectives (PEO)

- Acquire fundamental knowledge of mathematics, science and engineering to analyze, design and implement solutions to the Information Technology problems
- Understand emerging concepts and trends in Information Technology.
- Apply IT tools to develop innovative computational systems.
- The students are encouraged to develop the habit of lifelong learning to face the challenges.
- The students will be embedded as a responsible individual having ethical and social values to lead the society and to nurture team spirit.

Program Outcomes (PO)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

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Scheme of Instructions

Scheme of Instructions for First Year M. Tech. Program in Artificial Intelligence & Machine Learning


Semester – I (w.e.f.: AY 2021-22)


Sr.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT – 1	CT – 2	TA / CA	ESE	TOTAL
1.	PCC	MAI1101	Artificial Intelligence	3	-	-	3	3	15	15	10	60	100
2.	PCC	MAI1102	Natural Language Processing	3	-	-	3	3	15	15	10	60	100
3.	PCC	MAI1103	Probability & Statistics	3	-	-	3	3	15	15	10	60	100
4.	PCC	MAI1104	Laboratory –I (AI)	-	-	2	2	1	-	-	25	25	50
5.	PCC	MAI1105	Laboratory –II (NLP)	-	-	2	2	1	-	-	25	25	50
6.	PEC	MAI1106-09*	Professional Elective – I	3	-	-	3	3	15	15	10	60	100
7.	PEC	MAI1110-13*	Professional Elective - II	3	-	-	3	3	15	15	10	60	100
8.	MCC	MAU1101	Pedagogy Studies	2	-	-	2	Audit	-	-	-	-	-
Total				17	-	4	21	17	75	75	100	350	600


L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment ESE- End Semester Examination (For Laboratory: End Semester Performance)

* Indicates out of the four course codes each student has to select any one PEC from the list provided at the end of structure.

PROGRESSIVE TOTAL CREDITS= 17


BOS Chairman
 Head of Dept. (Information Technology)
 Tulsiramji Gaikwad-Patil College of
 Engineering & Technology, Nagpur.


Dean Academics
Dean Academics
 Tulsiramji Gaikwad-Patil
 College Of Engineering
 and Technology, Nagpur


Principal
Principal
 Tulsiramji Gaikwad - Patil College Of
 Engineering & Technology
 Nagpur

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Scheme of Instructions

Scheme of Instructions for First Year M. Tech. Program in Artificial Intelligence & Machine Learning

Semester – II (w.e.f.: AY 2021-22)

Sr.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT- 2	TA / CA	ESE	TOTAL
1.	PCC	MAI1201	Machine Learning for Data Analysis	3	-	-	3	3	15	15	10	60	100
2.	PCC	MAI1202	Big Data Mining And Analytics	3	-	-	3	3	15	15	10	60	100
3.	PCC	MAI1203	Information & Cyber Security	3	-	-	3	3	15	15	10	60	100
4.	PCC	MAI1204	Laboratory –III (ML using Python)	-	-	2	2	1	-	-	25	25	50
5.	PCC	MAI1205	Laboratory –IV (BDMA)	-	-	2	2	1	-	-	25	25	50
6.	FC	MAI1206	Research Methodology#	2	-	-	2	2	-	-	25	25	50
7.	PEC	MAI1207-10*	Professional Elective – III	3	-	-	3	3	15	15	10	60	100
8.	PEC	MAI1211-14*	Professional Elective – IV	3	-	-	3	3	15	15	10	60	100
9.	MCC	MAU1202	Research Paper Writing	2	-	-	2	Audit	-	-	-	-	-
Total				19	-	4	23	19	75	75	125	375	650

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment ESE- End

Semester Examination (For Laboratory: End Semester Performance)

≠ Students is expected to complete it online by appearing NPTEL/Swayam Certification for 03 credits. Weekly 02 Hrs practical in which students are expected to work on mathematical modeling.


Seminar on IPR, Patent filing, Removing Plagiarisms, etc. will be done.

* Indicates out of the four course codes each student has to select any one PEC from the list provided at the end of structure.

PROGRESSIVE TOTAL CREDITS= 17+19 = 36


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Scheme of Instructions

Scheme of Instructions for Second Year M. Tech. Program in Artificial Intelligence & Machine Learning

Semester – III (w.e.f.: AY 2021-22)

Sr.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1	PROJ	MAI2301	Dissertation Phase-I	-	-	20	20	10	-	-	100	100	200
2	PEC	MAI2302	MOOC course (8-12)\$	-	-	-	-	3	-	-	-	-	-
3	OEC	M\$XX01-06#	Open Elective –I	3	-	-	3	3	15	15	10	60	100
Total				3	-	20	23	16	-	-	110	160	300

ote:

1. MAI2301 will be decided by respective Guide in Consultation with Program Coordinator. Course is mandatory is for student and hisdissertation phase I will be considered incomplete without this Mandatory MOOC Course.
2. In Case, the course offered online are not completely relevant with the topic of dissertation then any course suggested by NASSCOM on recent technologies can be opted by candidate.
3. \$ Programme coordinator will provide list of 03 MOOC courses of minimum 08 weeks duration (as per availability). Students are expected to complete any one out of three courses in order to get the required credits.

Indicates out of the 06 course codes each student has to select any one OEC except MCSXX01

L- Lecture
CT1- Class Test 1
CT2- Class Test 2

T-Tutorial
P-Practical
TA/CA- Teacher Assessment/Continuous Assessment
ESE- End Semester Examination (For Laboratory End Semester performance)**PROGRESSIVE**

TOTAL CREDITS= 36+16 = 52

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Scheme of Instructions

Scheme of Instructions for Second Year M. Tech. Program in Artificial Intelligence & Machine Learning

Semester – IV (w.e.L.: AY 2021-22)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PROJ	MA12401	Dissertation Phase- II	-	-	32	32	16	-	-	100	200	300
			Total	-	-	32	32	16	-	-	100	200	300


TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

PROGRESSIVE TOTAL CREDITS= 52+16 = 68


BoS Chairman

Head of Dept. (Information Technology)
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Nagpur

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Scheme of Instructions

Scheme of Instructions for First Year/Second Year M. Tech. Program in Artificial Intelligence & Machine Learning

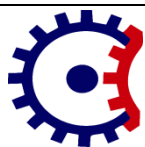
List of Professional Elective Courses

Semester-I			
Course Code	Professional Elective- I	Course Code	Professional Elective- II
MAI1106	Cloud Computing	MAI1110	Robotic Process Automation
MAI1107	Agent Based Intelligent Systems	MAI1111	Human Computer Interface
MAI1108	Fundamentals of Data Science	MAI1112	Advanced Algorithms and Analysis
MAI1109	Multi agent System	MAI1113	Security Analytics
	MOOCS Courses		MOOCS Courses

Semester-II			
Course Code	Professional Elective- III	Course Code	Professional Elective- IV
MAI1207	Pattern Recognition	MAI1211	Computer Vision
MAI1208	Reinforcement Learning	MAI1212	Data Visualization Techniques
MAI1209	Optimization Techniques	MAI1213	Block chain Technology
MAI1210	Artificial Neural Network (Deep Learning)	MAI1214	Advance Data Mining
	MOOCS Courses		MOOCS Courses

List of Open Electives

Semester-III	
Course Code	Open Elective- I
MCSXX01	Business Analytics
MSEX02	Cost Management of Engineering Projects
MSEX03	Composite Materials
MIPXX04	Waste to Energy
MIPXX05	Industrial Safety
MMBXX06	Operation Research



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1101: Artificial Intelligence

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites: Artificial Intelligence			Total Marks 100 Marks

Course Objectives:

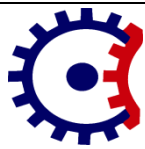
1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool
5. Experiment with a machine learning model for simulation and analysis

Course Contents

Unit I	Introduction of AI: Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.
Unit II	Knowledge representation: Knowledge Representation: Using Predicate logic, representing facts in logic, functions and predicates, Conversion to clause form, Resolution in propositional logic, Resolution in predicate logic, Unification. Representing Knowledge Using Rules: Procedural Versus Declarative knowledge, Logic Programming, Forward versus Backward Reasoning
Unit III	Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments, Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs; Alternative Approaches;
Unit IV	Learning Models Artificial Intelligence: Concept of learning, learning automation, Knowledge-Based Classification Inductive Learning, Deductive Learning: Feedback Based Classification Unsupervised Learning, Supervised Learning, Semi-supervised learning and Reinforcement Learning
Unit V	Expert Systems: Building an expert system, application areas of expert system Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Automated Reasoning, Rule-Based Expert Systems Case studies: MYCIN, R1, CaDeT, and DENDRAL.

Text Books	
T.1	E. Rich and K. Knight, “Artificial intelligence”, TMH, 2nd ed., 1992.
T.2	N.J. Nilsson, “Principles of AI”, Narosa Publ. House, 1990.
T.3	D.W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
Reference Books	
R.1	R.J. Schalkoff, “Artificial Intelligence -an Engineering Approach”, McGraw Hill Int. Ed., Singapore, 1992.
R.2	Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.
R.3	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall, 3 rd , 2009
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs42/preview
2	https://nptel.ac.in/courses/106/105/106105077/
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1101.1	Apply the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	PO1,PO2,P O3	3	9
MAI1101.2	Evaluate knowledge based system by problem solving technique.	PO1,PO2,P O3	5	9
MAI1101.3	Design a knowledge based system	PO1,PO2,P O3	6	9
MAI1101.4	Analyze important historical and current trends addressing artificial intelligence.	PO1,PO2,P O3	4	9
MAI1101.5	Judge the terminology used in knowledge based system and expert system.	PO1,PO2,P O3	5	9



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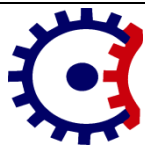


Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1102: Natural Language Processing

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:			Total Marks 100 Marks
Course Objectives:			
1.	To introduces the fundamental concepts and techniques of natural language processing (NLP).		
2.	To gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.		
3.	To examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.		
4.	To teach the principles and methods of statistical natural language processing and provide hands-on experience of text analysis using Python		
5.	To enable students to perform large-scale statistical analysis of textual data in authoritative way and find useful patterns from the data.		
Course Contents			
Unit I	Introduction and Overview: Motivations, what is Natural Language Processing, Ambiguity and uncertainty in language. The Turing test, NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, and machine translation. The problem of ambiguity. The role of machine learning.		
Unit II	Processing Raw Text: Strings-Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings		
Unit III	Learning to Classify Text: Supervised Classification, Evaluation, Modeling Linguistic Patterns Extracting Information from Text: Information, Chunking, Developing and Evaluating Chunkers Recursion in Linguistic Structure.		
Unit IV	Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, DirectMachineTranslations,Rule-BasedMachineTranslation,KnowledgeBasedMTSystem,StatisticalMachineTranslation,UNLBasedMachineTranslation, and TranslationinvolvingIndian Languages.		
Unit V	Information Extraction: Introduction to Named Entity Recognition and Relation ExtractionNatural Language Generation, thepotentialof usingML forNLG		
Text Books			
T.1	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.		
T.2	Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.		

T.3	Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.			
Reference Books				
R.1	Jensen K., Heidorn G.E., Richardson S.D., Natural Language Processing: The PLNLP Approach, Springer, 2013.			
R.2	Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press, 2008.			
R.3	Radford, Andrew et. al.,Linguistics, An Introduction, Cambridge University Press, 1999.			
Useful Links				
1	https://nptel.ac.in/courses/106/105/106105158/			
2	https://nptel.ac.in/courses/106/106/106106211/			
3	https://onlinecourses.nptel.ac.in/noc20_cs87/preview			
	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1102.1	Categorized various approaches to syntax and semantics in NLP.	PO1,PO2 ,PO3	4	9
MAI1102.2	Differentiate the approaches to discourse, generation, dialogue and summarization within NLP.	PO1,PO2 ,PO3	4	9
MAI1102.3	Classify current methods for statistical approaches to machine translation	PO1,PO2 ,PO3	4	9
MAI1102.4	Examine machine learning techniques used in NLP, including hidden Markov models and clustering and unsupervised methods.	PO1,PO2 ,PO3	5	9
MAI1102.5	Create the methods to new NLP problems and will be able to apply the methods to problems outside NLP.	PO1,PO2 ,PO3	6	9



Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1103: Probability And Statistics

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites: Basic calculus and statistics			Total Marks 100 Marks

Course Objectives:

- To provide basic probability concepts and statistical inference, which are fundamental statistical principles behind machine learning
- To provide an understanding of the basic concepts in probability theory and statistical analysis
- To introduce the basic concepts of two dimensional random variables
- To familiarize the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- To appreciate the diversity of the applications of hypothesis testing.

Course Contents

Unit I	Introduction to Sets : Introduction to Sets, Probability set function, Computer simulation ,Counting rules, Conditional probability, Discrete random variables, Continuous random variables, Expectation of random variables, Some special expectations, Important inequalities
Unit II	Random variables: Transformations, Conditional distributions, Correlation coefficients, Independent random, variables, Linear combinations
Unit III	Binomial distribution: Poisson distribution, Normal distribution, Multivariate normal, distribution, Gamma distribution, Chi-squared distribution, Beta distribution, 1 t distribution, 2 F distribution, Mixture distributions, Distributions of order statistics
Unit IV	Sampling and Statistics: Confidence intervals, Hypothesis testing, The Statistical Theory of Machine Learning, The frequentist school of statistics, Null hypothesis significant testing, comparison between frequentist and Bayesian Interface.
Unit V	Conditional probability: Bayes' theorem, independence, theorem of total probability, expectation and variance, few discrete and continuous distributions, joint distributions and covariance.

Text Books

T.1	W. Cheney, Analysis for Applied Mathematics. New York : Springer Science + Business Medias, 2001
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T.2	S. Axler, Linear Algebra Done Right (Third Edition). Springer International Publishing, 2015.
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Reference Books

R.1	Probability and Statistics for Engineering and the Sciences, 9E by Jay L. Devore, 2020.
R.2	Marc Perter Deisenroth, A. Aldo Fajal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.

Useful Links

1	https://nptel.ac.in/courses/106/105/106105173/
2	https://onlinecourses.nptel.ac.in/noc20_cs17/preview
3	https://nptel.ac.in/content/syllabus_pdf/106105173.pdf

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1103.1	Distinguish between Discrete random variables and Continuous random variables	P01,P02,P03	4	9
MAI1103.2	Categorize random variables required in statistics.	P01,P02,P03	4	9
MAI1103.3	Evaluate various distribution categories for machine learning.	P01,P02,P03	5	9
MAI1103.4	Analyze the central limit theorem to sampling distribution use estimation technique to determine point estimates confidence interval and sample size.	P01,P02,P03	4	9
MAI1103.5	Apply Probability theory in problem solving	P01,P02,P03	3	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester	Course Code	Name of Course	L	T	P	Credits
I	MAI1104	Artificial Intelligence Lab	-	-	2	1

Pre-Requisites: -

Course Objectives:

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool
5. Experiment with a machine learning model for simulation and analysis
6. Explore the current scope, potential, limitations, and implications of intelligent systems

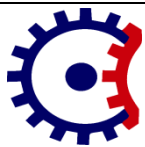
List of Experiment

1	Study of Prolog.
2	Write simple fact for the statements using PROLOG.
3	Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4	Write a program to solve the Monkey Banana problem
5	WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
6	WAP to implement factorial, fibonacci of a given number.
7	Write a program to solve 4-Queen problem
8	Write a program to solve traveling salesman problem
9	Write a program to solve water jug problem using LISP
10	Solve Robot (traversal) problem using means End Analysis

Text Books

T.1	E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
T.2	N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.
T.3	D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.

Reference Books				
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R.2	Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.			
R.3	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall, 3 rd , 2009			
Useful Links				
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2	https://nptel.ac.in/courses/106/105/106105077/			
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/			
	Course Outcomes	PO/PSO	CL	Lab Sessions
MAI1101.1	Apply the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	PO1,PO2,PO3	6	4
MAI1101.2	Evaluate knowledge based system by problem solving technique.	PO1,PO2,PO3	4	4
MAI1101.3	Design a knowledge based system	PO1,PO2,PO3	6	4
MAI1101.4	Analyze important historical and current trends addressing artificial intelligence.	PO1,PO2,PO3	4	4
MAI1101.5	Judge the terminology used in knowledge based system and expert system.	PO1,PO2,PO3	4	4



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester	Course Code	Name of Course	L	T	P	Credits
I	MAI1105	Natural Language Processing Lab	-	-	2	1

Pre-Requisites: -

Course Objectives:

1. This course introduces the fundamental concepts and techniques of natural language processing (NLP).
2. Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
3. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
4. This course is designed to teach the principles and methods of statistical natural language processing and provide hands-on experience of text analysis using Python
5. This course will enable students to perform large-scale statistical analysis of textual data in authoritative way and find useful patterns from the data. The expertise of natural language processing is also highly coveted in industries.

List of Experiment

1	Word Analysis in NLP
2	Word Generation
3	Tagging and Dependency Parsing using Feedforward Networks
4	Word Embeddings in Feedforward Networks
5	Computational Graphs, and Backpropagation
6	Parsing and Context-free Grammars
7	Maximum Entropy Markov model and conditional random field
8	Log-Linear Models
9	Tagging, and Hidden Markov Model
10	Recurrent Networks, and LSTMs, for NLP

Text Books

T.1	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
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T.2	Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
T.3	Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.

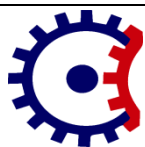
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R.1	Jensen K., Heidorn G.E., Richardson S.D., Natural Language Processing: The PLNLP Approach, Springer, 2013.
R.2	Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
R.3	Radford, Andrew et. al., Linguistics, An Introduction, Cambridge University Press, 1999.

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2	https://nptel.ac.in/courses/106/106/106106211/
3	https://onlinecourses.nptel.ac.in/noc20_cs87/preview

	Course Outcomes	PO/PSO	CL	Lab Sessions
MAI1102.1	Categorized various approaches to syntax and semantics in NLP.	PO1,PO2,PO3	4	4
MAI1102.2	Differentiate the approaches to discourse, generation, dialogue and summarization within NLP.	PO1,PO2,PO3	4	4
MAI1102.3	Classify current methods for statistical approaches to machine translation	PO1,PO2,PO3	4	4
MAI1102.4	Examine machine learning techniques used in NLP, including hidden Markov models and clustering and unsupervised methods.	PO1,PO2,PO3	5	4
MAI1102.5	Create the methods to new NLP problems and will be able to apply the methods to problems outside NLP.	PO1,PO2,PO3	4	4



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1106: Cloud Computing (Professional Elective-I)

Teaching Scheme			Examination Scheme	
Theory	3 Hrs/week		CT-I	15 Marks
Tutorial	-		CT-II	15 Marks
Total Credits	3		CA	10 Marks
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites:			Total Marks	100 Marks

Course Objectives:

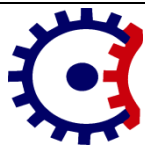
- To presents a top-down view of cloud computing, from applications and administration to programming and infrastructure
- To get in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing
- To provide a unified and fundamental view of the broad field of computer networks. Furthermore, the easy to understand and extremely relevant world of Computer Net working is introduced in a top down Approach.
- To provides detailed knowledge, practical training and insight into the implementation and management of various storage technologies with a focus towards applying these technologies in an information lifecycle paradigm
- To provide a sound foundation to the students on the concepts, percepts and practices in a field that is of immense concern to the industry and business

Course Contents

Unit I	Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers. Properties, Characteristics & Disadvantages - Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs Grid computing, Role of Open Standards.
Unit II	Cloud Architecture, Services And Storage: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Deployment Models, Public cloud, Private cloud, Hybrid cloud, Community cloud.
Unit III	Content Delivery Network: CDN Service Operations, Evolution of CDN, Advantages of CDN, Disadvantages of CDN, CDN Service Provider, Security Reference Model Security Issues-Cloud security, threats to Cloud Security, Infrastructure Security, Information Security, Identity Management and Access Control, Cloud Security Design Principles, Cloud Security Management Frameworks, Security-as-a-Service, Privacy and Compliance Issues.
Unit IV	Portability and Interoperability Issues -Challenges in the Cloud, The Issues in Traditional Computing, Addressing Portability and Interoperability in Cloud, Portability and Interoperability Scenarios, Machine Imaging or Virtual Machine Image, Virtual Appliance, Difference between Virtual Machine Image and Virtual Appliance, Open Virtualization Format (OVF), Cloud Management and a Programming Model Case Study, Popular Cloud Services.
Unit V	Service-Oriented Architecture: The Pre-SOA Era, Role of SOA in Cloud Computing, Service-Oriented Architecture, Goal of System Designing, Service Represents Business Functionality, Open Standard Implementation, Benefits of SOA, SOA and Cloud Computing. Database Technology: Database in Cloud, Data Models, Database-as-a-Service, Relational

	DBMS in Cloud, Non-relational DBMS in Cloud.
Text Books	
T.1	Essentials of cloud Computing: K.Chandrasekhran, CRC press, 2014.
T.2	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.
Reference Books	
R.1	Thomas Erl,Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology & Architecture", Prentice Hall, 2013.
R.2	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw- Hill,2013.
R.3	Toby Velte,Anthony Velte,Robert C. Elsenpeter, "Cloud Computing, A Practical Approach",Tata McGraw-Hill Edition, 2010.
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://onlinecourses.nptel.ac.in/noc19_cs64/preview
3	https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-cs23/

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1106.1	Explain the concepts, characteristics, delivery models and benefits of cloud computing	PO1,PO2,PO3	4	9
MAI1106.2	Design system, network and storage virtualization and outline their role in enabling the cloud Computing system model.	PO1,PO2,PO3	6	9
MAI1106.3	Summarize fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost	PO1,PO2,PO3	5	9
MAI1106.4	Compare the key security and compliance challenges of cloud computing	PO1,PO2,PO3	4	9
MAI1106.5	Analyze various cloud programming models and apply them to solve problems on the cloud.	PO1,PO2,PO3	4	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1107: Agent Based Intelligent Systems (Professional Elective-I)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:			Total Marks 100 Marks

Course Objectives:

- To understand Agent development
- To gain Knowledge in Multi agent and Intelligent agents
- To understand Agents and security
- To gain Knowledge in Agent Applications
- To provide knowledge about autonomous intelligent agents, agent technologies, mobility of agents, agent platforms, multi-agent system, agent communication, agent coordination, agent negotiation, agent intelligence, Semantic modelling of agents, agent based industrial application and system.

Course Contents

Unit I	Introduction: Agents as a paradigm for software engineering, Agents as a tool for understanding human societies, Intelligent Agent: Agents and Objects, Agents and Expert Systems, Agents as Intentional Systems, Abstract Architectures for Intelligent Agents, How to Tell an Agent What to Do.
Unit II	Reaching Agreements – Mechanism Design; Auctions; Negotiation; Communication – Speech Acts; Agent Communication Languages; Ontologies for Agent Communications; Coordination Languages.
Unit III	Practical Reasoning Agents – Practical Reasoning Equals Deliberation Plus Means-Ends Reasoning; Means-Ends Reasoning; Implementing a Practical Reasoning Agent; HOMER: an Agent That Plans; The Procedural Reasoning System. Reactive and Hybrid Agents – Books and the subsumption Architecture; The Limitations of Reactive Agents; Hybrid Agents Multiagent Interactions – Utilities and preferences; Multiagent Encounters; Dominant Strategies and Nash Equilibria; Competitive and Zero-sum interactions; The Prisoner's Dilemma; Dependence relations in multi-agent systems
Unit IV	Developing Intelligent Agent Systems: Situated Agents, Actions and Percepts, Proactive and Reactive Agents: Goals and Events, Challenging Agent Environments: Plans and Beliefs of Social Agents, Agent Execution Cycle, Deciding on the Agent Types, Grouping functionalities, Review Agent Coupling- Acquaintance Diagrams-Develop Agent Descriptors.

Unit V	Applications: Agent for workflow and business process management, Mobile agents, Agents for distributed systems, agents for information retrieval and management, agents for electronic commerce agent for human computer interface agents for virtual environments agents for social simulation.
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Text Books

T.1	Ronald Brachman, Hector Levesque—Knowledge Representation and Reasoning, The Morgan Kaufmann Series in Artificial Intelligence 2004.
T.2	Arthur B. Markman, —Knowledge Representation, Lawrence Erlbaum Associates, 1998
T.3	Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving by Zili Zhang , Chengqi Zhang, Springer; 2004.

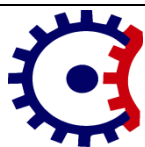
Reference Books

R.1	Michael Wooldridge, an Introduction to Multi Agent Systems, Second Edition, John Wiley and Sons, 2009.
R.2	Stuart Russell, Peter Norvig, —Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education, 2009.
R.3	Lin Padgham, Michael Winikoff, Developing Intelligent Agent Systems: A Practical Guide, Wiley publications, 2005.

Useful Links

1	https://nptel.ac.in/courses/106/105/106105077/
2	https://nptel.ac.in/courses/106/105/106105078/
3	https://nptel.ac.in/content/storage2/courses/109101003/downloads/Lecture-notes/Lecture-19-20-21.pdf

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1107.1	Explain the factors of the basic artificial intelligence techniques.	PO1,PO2,PO3	4	9
MAI1107.2	Differentiate between intractably with procedural control of reasoning.	PO1,PO2,PO3	4	9
MAI1107.3	Create an agent within a simulated agent trading environment	PO1,PO2,PO3	6	9
MAI1107.4	Construct Intelligent Agent Systems by applying various principles.	PO1,PO2,PO3	6	9
MAI1107.5	Analyze and critique the performance of a deployed agent	PO1,PO2,PO3	4	9



Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1108: Fundamentals of Data Science (Professional Elective-I)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:		Total Marks	100 Marks

Course Objectives:

- To get specialization demystifies data science and familiarizes learners with key data science skills, techniques, and concepts
- To aware about foundational concepts such as analytics taxonomy, the Cross-Industry Standard Process for Data Mining, and data diagnostics, and then moves on to compare data science with classical statistical techniques.
- To provide an overview of the most common techniques used in data science, including data analysis, statistical modeling, data engineering, manipulation of data at scale (big data), algorithms for data mining, data quality, remediation and consistency operations.
- To understand the Data Science Field, Learn primary tools used for data science in Python including Pandas and Scikit-learn, Learn how to perform exploratory data analysis
- To introduce you to a range of topics and concepts related to the *data science* process

Course Contents

Unit I	Introduction: What is Data Science? Big Data and Data Science – Datafication - Current landscape of perspectives - Skill sets needed; Matrices - Matrices to represent relations between data, and necessary linear algebraic operations on matrices -Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics: distributions and probability - Statistical Inference: Populations and samples - Statistical modeling - probability distributions - fitting a model - Hypothesis Testing - Intro to R/ Python.
Unit II	Data preprocessing: Data cleaning - data integration - Data Reduction Data Transformation and Data Discretization. Evaluation of classification methods – Confusion matrix, Students T-tests and ROC curves-Exploratory Data Analysis - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA - The Data Science Process.
Unit III	Basic Machine Learning Algorithms: Association Rule mining - Linear Regression- Logistic Regression - Classifiers - k-Nearest Neighbors (k-NN), k-means -Decision tree - Naive Bayes- Ensemble Methods - Random Forest. Feature Generation and Feature Selection - Feature Selection algorithms - Filters; Wrappers; Decision Trees; Random Forests.
Unit IV	Clustering: Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN - Relative merits of each method - clustering tendency and quality.
Unit V	Data Visualization: Basic principles, ideas and tools for data visualization.

Text Books

T.1	Cathy O'Neil and Rachel Schutt, “ Doing Data Science, Straight Talk From The Frontline”, O'Reilly, 2014.
T.2	Jiawei Han, MichelineKamber and Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition. ISBN 0123814790, 2011.

T.3	Mohammed J. Zaki and Wagner Miera Jr, “Data Mining and Analysis: Fundamental Concepts and Algorithms”, Cambridge University Press, 2014.
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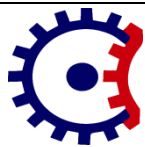
Reference Books

R.1	Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
R.2	Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015.
R.3	Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O'Reilly Media, 2012.

Useful Links

1	https://nptel.ac.in/courses/106/106/106106212/
2	https://nptel.ac.in/courses/106/106/106106179/
3	https://nptel.ac.in/courses/110/106/110106064/

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1108.1	Discriminate the fundamental concepts of data science	PO1,PO2,PO3	5	9
MAI1108.2	Evaluate the data analysis techniques for applications handling large data	PO1,PO2,PO3	5	9
MAI1108.3	Demonstrate the various machine learning algorithms used in data science process	PO1,PO2,PO3	3	9
MAI1108.4	Analyze the ethical practices of data science	PO1,PO2,PO3	4	9
MAI1108.5	Explain data visualization, Basic principles, ideas and tools for data visualization	PO1,PO2,PO3	4	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1109: Multi Agent System(Professional Elective-I)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:			Total Marks 100 Marks

Course Objectives:

1. To understand the conceptual and technical foundation of multi-agent systems
2. To gain Knowledge in Multi agent and Intelligent agents.
3. To understand Agents and security
4. To gain Knowledge in Agent Applications
5. To understand Agent development

Course Contents

Unit I	Agent Definition, Agent Programming Paradigms, Agent Vs. Object, Agent, Mobile Agents, Agent Frameworks, Agent Reasoning, Interface Agents: Metaphors with Character, Processes, threads, daemons, Components, Java Beans, ActiveX, Sockets, RPCs, Distributed Computing.
Unit II	Agent-Oriented Programming, Jini Architecture, Actors and Agents, Typed and proactive messages, Interaction between agents, Reactive Agents, Cognitive Agents, Interaction protocols, Agent coordination, Agent negotiation, Software Agent for Cooperative Learning, Agent Organization, Self - interested agents in electronic commerce applications, Interface Agents, Agent Communication Languages, Agent Knowledge representation.
Unit III	Agent adaptability, Agent-Based Framework for Interoperability, Agents for Information Gathering, Belief Desire Intension, Mobile Agent Applications, Towards an Industrial-Strength Open Agent Architecture, Agent Security Issues, Mobile Agents Security, Protecting Agents against Malicious Hosts, Untrusted Agent, Black Box Security, Authentication for agents, Security issues for aglets.
Unit IV	Multi Agent system: Theoretical approaches and NASA applications – Agent based control for multi-UAV information collection- Agent based decision support system for Glider pilots – Multi agent system in E- Health
Unit V	Territorial Emergencies – Software Agents for computer network security- Multi-Agent Systems, Ontologies and Negotiation for Dynamic Service Composition in Multi-Organizational Environmental Management.

Text Books

T.1	Jeffrey M. Bradshaw, Software Agents, AAAI Press , 1997
T.2	Richard Murch, Tony Johnson, Intelligent Software Agents, Prentice Hall , 1999

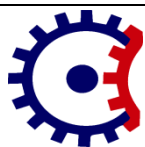
Reference Books

R.1	Gerhard Weiss, Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence, MIT Press , 2016.
R.2	Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015.

Useful Links

1	https://nptel.ac.in/courses/106/106/106106212/
2	https://nptel.ac.in/courses/106/106/106106179/
3	https://nptel.ac.in/courses/108/106/108106098/

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1109.1	Categorize development of software agents	PO1,PO2,PO3	4	9
MAI1109.2	Explain Knowledge in Multi agent and Intelligent agents	PO1,PO2,PO3	4	9
MAI1109.3	Compare Agent Security Issues & protect them.	PO1,PO2,PO3	5	9
MAI1109.4	Design various applications of Agent based decision support system	PO1,PO2,PO3	6	9
MAI1109.5	Measure various Software Agents for computer network security	PO1,PO2,PO3	5	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1110: Robotic Process Automation(Professional Elective-II)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:		Total Marks	100 Marks

Course Objectives:

- To study the design aspects of an automation system
- To learn about the design of belt conveyors
- To understand the issues involved during integration of automation components
- To give an overview of robotic process automation (RPA) technology. You will learn the characteristics, benefits, risks, and challenges of RPA
- To learn about RPA landscape, how RPA is transforming businesses, and how it is affecting accounting and finance professionals

Course Contents

Unit I	Introduction to Robotic Process Automation Why RPA? Industry Implementation of RPA RPA Growth Trends Different RPA Tools Types of Bots
Unit II	Getting started with UiPath automation Getting Started with UiPath Project and Project Types UiPath Dashboard Files in UiPath Sequence and Flowcharts State Machine
Unit III	UI Automation and System Activities What is UI Automation? System Activities Demo on System Activities Variables and Arguments Output Panel Custom Packages
Unit IV	Components of RPA, RPA platforms, The future of automation Introduction to Automation Anywhere, Automation Anywhere Architecture, Automation Anywhere Editors.
Unit V	Data Manipulation: Variables and scope, Variable Operation, String Operation, Comment, Interactive: Prompt Message Box, Clipboard management, File operation with step-by-step example: Read cell, Write cell, Read range, Write range, Append range, CSV/Excel to data table and vice versa: Reading an Excel file and creating a data table by using data from the Excel file, Creating a data table and then writing all its data to an Excel file.

Text Books

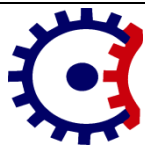
T.1	Pethuru Raj and Anupama C. Raman , “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press.
T.2	Richard Murch, Tony Johnson, Intelligent Software Agents, Prentice Hall , 1999

Reference Books

R.1	Gerhard Weiss, Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence, MIT Press , 2016.
R.2	Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, Springer

Useful Links

1	https://nptel.ac.in/courses/106/106/106106212/			
2	https://nptel.ac.in/courses/106/106/106106179/			
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview			
	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1110.1	Design in automating Windows, web, and Java-based applications	PO1,PO2,PO3	6	9
MAI1110.2	Construct knowledge of fundamental UI automation concepts	PO1,PO2,PO3	6	9
MAI1110.3	Create ability to create and debug workflows using UiPath	PO1,PO2,PO3	6	9
MAI1110.4	Distinguish installation of UiPath Studio on Windows	PO1,PO2,PO3	4	9
MAI11105	Decide to implement error exception handling	PO1,PO2,PO3	5	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1111: Human Computer Interface (Professional Elective-II)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:		Total Marks	100 Marks

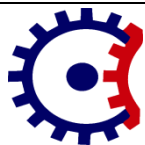
Course Objectives:

1. Provide an overview of the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable.
2. Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces
3. Understand the important aspects of implementation of human-computer interfaces
4. Identify the various tools and techniques for interface analysis, design, and evaluation.
5. Identify the impact of usable interfaces in the acceptance and performance utilization of information systems.

Course Contents

Unit I	Introduction to Human-Computer Interaction: Includes the difference between good and poor interaction design, what interaction design is and how it relates to human-computer interaction and other fields, what is involved in the process of interaction design, the different forms of guidance used in interaction design, etc.
Unit II	Interaction Design: Involves communication and collaboration, the main kinds of social mechanisms that are used by people to communicate and collaborate, the range of collaborative systems that have been developed to support this kind of social behavior, how field studies and socially based theories can inform the design of collaborative systems, etc.
Unit III	Understanding Business Functions: Business Definitions & Requirement analysis, Determining Business Functions, Design standards or Style Guides, System Training and Documentation, Principles of Good Screen Design: Human considerations in screen Design, interface design goals, test for a good design, screen meaning and purpose, Technological considerations in Interface Design System Menus and Navigation Schemes: Structure, Functions, Context, Formatting, Phrasing and Selecting, Navigating of Menus, Kinds of Graphical Menus Windows Interface: Windows characteristic, Components of Window, Windows Presentation Styles, Types of Windows, Window Management, Web systems.
Unit IV	Device and Screen-Based Control: Device based controls, Operable Controls, Text entry/read- Only Controls, Section Controls, Combining Entry/Selection Controls, Other Operable Controls and Presentation Controls, Selecting proper controls.
Unit V	Effective Feedback Guidance and Assistance: Providing the Proper Feedback, Guidance and Assistance Effective Internationalization and Accessibility- International consideration, Accessibility, Create meaningful Graphics, Icons and Images, Colors-uses, possible problems with colors, choosing colors.

Text Books				
T.1	Interaction design: Beyond Human-Computer Interaction, 4/e J. Preece, Y. Rogers and H. Sharp John Wiley & Sons 2015			
T.2	Designing the User Interface, 5/e Shneiderman B., Plaisant C., Cohen M., Jacobs S. Pearson 2013			
Reference Books				
R.1	Intelligent User Interfaces: Adaptation and Personalization Systems and Technologies Systems C. Mourlas, P. Germanakos IGI Global 2008			
Useful Links				
1	https://nptel.ac.in/courses/106/103/106103115/			
2	https://nptel.ac.in/courses/106/106/106106177/			
3	https://nptel.ac.in/content/storage2/courses/106103115/module1/1.pdf			
	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1111.1	Summarize an overview of the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable	PO1,PO2,PO3	5	9
MAI1111.2	Demonstrate the theoretical dimensions of human factors involved in the acceptance of computer interfaces	PO1,PO2,PO3	3	9
MAI1111.3	Explain the important aspects of implementation of human-computer interfaces	PO1,PO2,PO3	4	9
MAI1111.4	Evaluate the various tools and techniques for interface analysis, design, and evaluation.	PO1,PO2,PO3	5	9
MAI1111.5	Design the impact of usable interfaces in the acceptance and performance utilization of information systems.	PO1,PO2,PO3	6	9



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Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1112: Advanced Algorithms and Analysis (Professional Elective-II)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:		Total Marks	100 Marks

Course Objectives:

1. Develop 'students' algorithmic thinking and their ability to analyze the efficiency of algorithms;
2. Enable students to find different approaches for dealing with challenging computational problems;
3. Provide insight into cutting-edge research-led teaching in modern subfields of algorithms theory
4. Learn the main techniques of algorithm analysis and design.
5. Building a repertory of basic algorithmic solutions to problems in many domains.

Course Contents

Unit I	Design Paradigms: Overview: Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.
Unit II	Max Flow Problem String Matching Introduction to string-matching problem, Naïve algorithm, Rabin Karp, Knuth Morris Pratt, Boyer Moore algorithms and complexity analysis
Unit III	Theory of NP- Hard and NP-Complete Problems. P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.
Unit IV	Approximation Algorithms Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms
Unit V	Parallel Algorithms Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity. Probabilistic Algorithms & Randomized Algorithms Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

Text Books

T.1	Introduction to Algorithms : T.H. Cormen, C.E.Leiserson and R.L. Rivest
T.2	Fundamentals of Algorithmics : G.Brassard and P.Bratley

Reference Books

R.1	Randomized Algorithms: R. Motwani and P.Raghavan
R.2	Reference book: Algorithmics :The spirit of computing: D.Harel

Useful Links

1	https://nptel.ac.in/courses/106/101/106101060/			
2	https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-cs20/			
3	https://onlinecourses.nptel.ac.in/noc19_cs47/preview			
	Course Outcomes	PO/PSO	CL	Class Sessions
MAI1112.1	Analyze the running time of the basic algorithms for those classic problems in various domains	PO1,PO2,PO3	4	9
MAI1112.2	Explain the asymptotic performance of algorithms in terms of average case, best case & worst case complexities.	PO1,PO2,PO3	4	9
MAI1112.3	Demonstrate the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.	PO1,PO2,PO3	3	9
MAI1112.4	Evaluate the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.	PO1,PO2,PO3	5	9
MAI1112.5	Formulate the greedy algorithm and explain when an algorithmic design situation calls for it.	PO1,PO2,PO3	6	9



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)



Program: M. Tech. Artificial Intelligence & Machine Learning

Semester-I MAI1113: Security Analytics (Professional Elective-II)

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	CT-I	15 Marks
Tutorial	-	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3Hrs		ESE	60 Marks
Pre-Requisites:			Total Marks 100 Marks

Course Objectives:


1. This course focuses on the fundamental principles and techniques of security analysis
2. Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization.
3. Practice with an expertise in academics to design and implement security solutions. Understand key terms and concepts in Cryptography, Governance and Compliance.
4. Develop cyber security strategies and policies Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

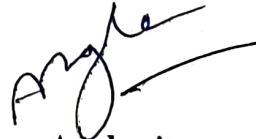
Course Contents


Unit I	Introduction to Cyber Security Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.
Unit II	Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception,
Unit III	Securing Web Application, Services and Servers Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.
Unit IV	Intrusion Detection and Prevention Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation
Unit V	Cyberspace and the LawIntroduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Text Books	
T.1	Security Risk Management: Building an Information Security Risk Management Program from the Ground Up by Evan Wheeler
T.2	William Stallings, "Cryptography and Network Security: Principle and Practice", Fifth Edition, Pearson.
Reference Books	
R.1	AtulKahate, "Cryptography and Network Security", Tata-McGraw hill.
R.2	Josef Pieprzyk, Thomas Hardjono, Jennifer Seberry, "Fundamentals of computer Security", Springer.
Useful Links	
1	https://nptel.ac.in/courses/106/101/106101060/
2	https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-cs20/
3	https://onlinecourses.nptel.ac.in/noc21_mg99/preview

	Course Outcomes	PO/PSO	CL	Class Sessions
MAI11131	Compare the concept of information security, encryption techniques, substitution and transposition techniques	PO1,PO2,PO3	4	9
MAI1113.2	Compare Differential and linear Cryptanalysis; Confidentiality, key distribution	PO1,PO2,PO3	4	9
MAI1113.3	Explain the knowledge of Public key cryptography with Hash function and algorithm	PO1,PO2,PO3	4	9
MAI1113.4	Illustrate the concept of Secure hash algorithm, Digital Signature Standard and Kerberos	PO1,PO2,PO3	5	9
MAI1113.5	Differentiate PGP, S/MIME and IP Security	PO1,PO2,PO3	4	9


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