Pimpri Chinchwad Education Trust's

Pimpri Chinchwad University

Sathe, Pune - 412106

PCET's Pimpri Chinchwad University

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Curriculum Structure

Computer Science and Engineering

M. Tech-CSE (AI)

(Batch: 2024-2026)

School of Engineering and Technology

Effective from Academic Year 2024-25

Program Structure

Version 1.2

Preamble:

The curriculum of M.Tech Computer Science and Engineering program offered by the Department of Computer Science Engineering under Academic Regulation of NEP 2020 is prepared in accordance with the curriculum framework of AICTE, UGC and Maharashtra State Council of Higher Education, National Higher Education Qualifications Framework (NHEQF) and National Credit Framework (NCrF). Further this Outcome Based Curriculum (OBC) is designed with Choice Based Credit and Semester System (CBCSS) enabling the learners to gain professional competency with multi-disciplinary approach catering the minimum requirement (Program Specific Criteria) of Lead Societies like AICTE,ACM and other Professional Bodies as per the Engineering Accreditation Commission (EAC) of ABET and NBA. In addition, the curriculum and syllabi are designed in a structured approach by deploying Feedback Mechanism on Curriculum from various stakeholders viz. Industry, Potential Employers, Alumni, Academia, Professional Bodies, Research Organizations and Parents to capture their voice of the respective stakeholders. The Curriculum design, delivery, and assessment, the three major pillars of academic system is completely aligned inline with Outcome Based Education (OBE) to assess and evaluate the learning outcomes to facilitate the learners to achieve their Professional and Career Accomplishments.

After due deliberations, the scheme and syllabus have been formulated. Salient features of this model curriculum are enumerated as under:

1. Reduced number of credits.
2. Well defined learning objectives & outcomes for each course.
3. Inclusion of courses on socially relevant topics.
4. Built-in flexibility to the students in terms of professional elective and open elective courses and minor course.
5. Mandatory internship to equip the students with practical knowledge and provide them exposure to real time industrial environments.
6. Mapping of Courses to its equivalent NPTEL/SWAYAM Course.

Vision and Mission of Program:

Vision:

To develop engineers well versed with Critical Theory and Practical's (problem solving ability); and sensitive to National and Global challenges from Inter-disciplinary perspective. To create Industry ready, socially and ethically strong professionals

Mission:

Our mission is

- To develop the Computer Professionals by imparting computer engineering knowledge with professional ethics.
- To provide the service to the communities to which we belong at local and national levels, combined with a deep awareness of our ethical responsibilities to our profession and to society.

Program Educational Objectives:

Program Educational Objectives (PEOs) for a MTECH in Computer Science and Engineering program are as follows:

- **PEO 1:** To provide students with knowledge and skills to become leading experts in the field of computer science engineering.

- **PEO 2:** To provide an innovative and comprehensive curriculum that integrates theoretical knowledge with practical experience, research opportunities, and professional development
- **PEO 3:** To groom the student's overall personality for professional growth.
- **PEO 4:** To inculcate values and ethics among the students and making them aware about their social commitments.

Program Outcome

Program Outcomes (POs) at the end of program, students should be able to

PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Object

Program Specific Outcomes (PSOs) at the end of program, students should be able to

PSO1	Use knowledge to write programs and integrate them with the hardware/software products in the domains of artificial Intelligent systems, data Science, networking and web technology.
PSO2	Participate in planning and implement solutions to cater to business specific requirements, Inculcate team dynamics and professional ethics.

INDEX

Sr. No.	Type of course	Abbreviations
1	Basic Science Course (BSC)	**BSC**
2	Engineering Science Course(ESC)	**ESC**
3	Programme Core Course (PCC)	**PCC**
4	Programme Elective Course (PEC)	**PEC**
5	Multidisciplinary Minor (MD M)	**MIN**
6	Open Elective (OE) Other than a particular program	**OE**
7	"Vocational and Skill Enhancement Course (VSEC)"	**VSEC**
8	Ability Enhancement Course (AEC -01, AEC-02)	**AEC**
9	Entrepreneurship/Economics/ Management Courses	**MGMT**
10	Indian Knowledge System (IKS)	**IKS**
11	Value Education Course (VEC)	**VEC**
12	Research Methodology	**RM**
13	Comm. Engg. Project (CEP)/Field Project (FP)	**CEP/FP**
14	Project	**PROJ**
15	Internship/ OJT	**OJT**
16	Co-curricular Courses (CC)	**CC**
17	Massive Open Online Courses (MOOC)	**MOOC**

SEMESTER - I

Course Code	Course Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	CREDITS	HRS	CIA	ESA	PR /OR	Total
PMTAI501	PCC	Research Methodology and IPR	3	-	-	3	3	40	60	-	100
PMTAI502	PCC	Artificial Intelligence and Knowledge Representation	3	-	-	3	3	40	60	-	100
PMTAI503	PCC	Artificial Intelligence and Knowledge Representation Lab	-	1	-	1	2	25	-	25	50
PMTAI504	PCC	Machine Learning Techniques	3	-	-	3	3	40	60	-	100
PMTAI505	PCC	Machine Learning Techniques Lab	-	1	-	1	2	25	-	25	50
PMTAI506	MOOC	MOOC1	-	-	4	4	8	40		60	100
PMTAI507	PCC	Seminar and Research Paper Writing I	-	4	-	4	8	50		50	100
PMTAI508	VSEC	Advanced Python Programming	-	1	-	1	2	25	-	25	50
		Total	**9**	**7**	**-**	**20**	**31**	**285**	**180**	**185**	**650**

SEMESTER - II

Course Code	Course Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	CREDITS	HRS.	CIA	ESA	PR /OR	Total
PMTAI509	PCC	Deep Learning Techniques	3	-	-	3	3	40	60	-	100
PMTAI510	PCC	Deep Learning Techniques Laboratory	-	1	-	1	2	25	-	25	50
PMTAI511	PCC	Natural Language Processing	3	-	-	3	3	40	60	-	100
PMTAI512	PCC	Natural Language Processing Lab	-	1	-	1	2	25	-	25	50
PMTAI513	PCC	Advanced Statistical Techniques	2	-	-	2	2	40	60	-	100
PMTAI514	MOOC	MOOC2		-	4	4	8	40	-	60	100
PMTAI515	VSEC	Data Visualization Techniques	-	2	-	2	4	25	-	25	50
PMTAI516	PCC	Seminar and Research Paper II	-	4	-	4	8	50	-	50	100
		Total	**8**	**8**	**4**	**20**	**32**	**285**	**180**	**185**	**650**

SEMESTER - III

Course Code	Course Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	CREDITS	HRS.	CIA	ESA	PR /OR	Total
PMTAI601	PCC	MOOC 3			2	2	4	40		60	100
PMTAI602	PCC	MOOC 4			2	2	4	40		60	100
PMTAI603	PROJ	Project Phase I		**10**	-	10	20	200	-	200	400
PMTAI604	INT	Internship		**6**		6	12	50	-	50	100
		Total	**4**	**26**	**2**	**20**	**40**	**330**	**-**	**370**	**700**

SEMESTER - IV

Course Code	Course Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	CREDITS	HRS.	CIA	ESA	PR /OR	Total
PMTAI605	PROJ	Project Phase II	-	10	-	10	20	250	-	250	500
PMTAI606	PROJ	Seminar	-	6	-	6	12	50	-	50	100
PMTAI607	PCC	MOOC5	-	-	4	4	8	40	-	60	100
		Total	**-**	**40**	**-**	**20**	**44**	**340**	**-**	**360**	**700**

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COURSE SYLLABUS MTECH CSE (AI) SEMESTER-I

COURSE CURRICULUM

Name of the Program:		**M. TECH CSE (AI)**			**Semester: I**	**Level: PG**	
Course Name		**Research Methodology and IPR**			**Course Code/ Course Type**	**PMTAI501**	
Course Pattern		**2024**			**Version**	**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	0	0	3	3	40	60	-

Pre-Requisite:

1. Basic Understanding of Computer Science Concepts
2. Critical Thinking and Analytical Skills

Course Objectives (CO):	**The objectives of RM&IPR are to:** 1. Learn research fundamentals to develop solid understanding of research ethics. 2. Learn various research designs and methodologies, including experimental, survey, and case study designs. 3. Enhance written and oral communication skills for presenting research proposals, findings, and conclusions. 4. Develop a comprehensive understanding of intellectual property rights, including patents, copyrights, trademarks, and trade secrets. 5. Gain knowledge of national and international laws and regulations governing intellectual property rights.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate research problems and gain research ethics. 2. Use various research designs. 3. Explore the presentation skills in research proposals and writings. 4. Use the tools filing the patents and IPR. 5. Apply the different laws and regulations for IP rights.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Research Methodology - Understanding research, types of research, and the scientific method. Research ethics and integrity. **Problem Formulation and Literature Review:** Identifying research problems. Reviewing existing literature and formulating research questions.	**CLO 1**	**9**
UNIT II		
Research Design: Experimental design. Survey design. Case study design. Qualitative and quantitative research methods. **Data Collection and Analysis:** Methods of data collection (surveys, interviews, experiments, etc.). Data analysis techniques (qualitative and quantitative).	**CLO 2**	**9**
UNIT III		
Writing and Presenting Research: Research proposal writing. Academic writing style and citation. Presenting research findings: oral presentations and posters. **Research Project Management:** Time management. Resource allocation. Risk assessment and mitigation.	**CLO 3**	**9**
UNIT IV		
Introduction to Intellectual Property: Overview of intellectual property rights (patents, copyrights, trademarks, trade secrets). Importance of IPR in the context of technology and innovation. **Patents:** Basics of patent law and patentability criteria. Patent filing procedure. Patent searching and analysis.	**CLO 4**	**9**
UNIT V		
IPR Issues in Research and Development: IP management strategies for research institutions and companies. IP licensing and technology transfer. **International IPR Laws and Treaties:** Overview of international treaties like TRIPS Agreement. Comparison of IPR laws across different jurisdictions. **IPR Enforcement and Litigation:** Legal remedies for IPR infringement. Case studies of notable IPR disputes. **Emerging Issues in IPR:** IPR challenges in emerging technologies (AI, blockchain, etc.). Ethical considerations in IPR.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Research Methodology: Methods and Techniques by C.R. Kothari
2. Research Methodology: A Step-by-Step Guide for Beginners by Ranjit Kumar
3. Intellectual Property Rights: Text and Cases" by V.K. Ahuja

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell
2. Intellectual Property: Patents, Trademarks, and Copyrights by Richard Stim
3. Intellectual Property Law: Text, Cases, and Materials by Tanya Aplin and Jennifer Davis

Online Resources/E-learning Resources:

1. https://www.coursera.org/search?query=research%20methodology
2. https://www.edx.org/search?q=research+methodology

Name of the Program:		**M.TECH CSE(AI)**		**Semester : I**		**Level: PG**	
Course Name		**Artificial Intelligence and Knowledge Representation**		**Course Code/Course Type**		**PMTAI502**	
Course Pattern		**2024**		**Version**		**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	NA	NA	3	3	40	60	NA
Pre-Requisite: Knowledge of Data Structures							
Course Objectives (CO):				**The objectives of AI &KR are to:** 1. Learn the informed and uninformed problem types and apply search strategies to solve them. 2. Apply difficult real life problems in a state space representation so as to solve those using AI techniques like searching and game playing. 3. Design and evaluate intelligent expert models for perception and prediction from intelligent environment. 4. Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques. 5. Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.		
Course Learning Outcomes (CLO):				**Students would be able to:** 1. Identify problems that are amenable to solution by specific AI methods 2. Represent knowledge in Prolog and write code for drawing inferences. 3. Identify appropriate AI technique for the problem at hand 4. Compare strengths and weaknesses of different artificial Intelligence techniques. 5. Sensitive towards development of responsible Artificial Intelligence.		

Course Contents

Descriptors/Topics	CLO	Hours
UNIT I		
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.	**CLO 1**	**9**
UNIT II		
Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.	**CLO 2**	**9**
UNIT III		
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	**CLO 3**	**9**
UNIT IV		
Reasoning with Uncertain Knowledge: Uncertainty, non-monotonic reasoning, truth maintenance systems, default reasoning and closed world assumption, Introduction to probabilistic reasoning, Bayesian probabilistic inference, introduction to fuzzy sets and fuzzy logic, reasoning using fuzzy logic. .	**CLO 4**	**9**
UNIT V		
Expert System: Representing and using Domain Knowledge, Reasoning with knowledge, Expert System Shells, Support for explanation examples, Knowledge acquisition-examples.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Text Books:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
2. Artificial Intelligence, Kevin Knight, Elaine Rich, B. Shivashankar Nair, 3rd Edition,2008
3. Artificial Neural Networks B. Yagna Narayana, PHI.
4. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).

Reference Books:

1. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
2. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
3. Neural Networks Simon Haykin PHI.
4. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition

Online Resources/ E-learning Resources:

1. https://cyber.harvard.edu/topics/ethics-and-governance-ai
2. https://royalsocietypublishing.org/doi/full/10.1098/rsta.2018.0085
3. https://arxiv.org/abs/1812.02953

Name of the Program:	**M.TECH CSE(AI)**			**Semester : I**		**Level: PG**	
Course Name	**Artificial Intelligence and Knowledge Representation lab**			**Course Code/Course Type**		**PMTAI503**	
Course Pattern	**2024**			**Version**		**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
NA	1	NA	1	2	25	NA	25
Pre-Requisite: Knowledge of Data Structures							
Course Objectives (CO):				**The objectives of AI &KR Lab are to:** 1. Comprehend the informed and uninformed problem types and apply search strategies to solve them. 2. Apply difficult real life problems in a state space representation so as to solve those using AI techniques like searching and game playing. 3. Design and evaluate intelligent expert models for perception and prediction from intelligent environment. 4. Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques. 5. Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.			
Course Learning Outcomes (CLO):				**Students would be able to:** 1. Identify problems that are amenable to solution by specific AI methods 2. Represent knowledge in Prolog and write code for drawing inferences. 3. Identify appropriate AI technique for the problem at hand 4. Compare strengths and weaknesses of different artificial Intelligence techniques. 5. Sensitive towards development of responsible Artificial Intelligence			

Practical Plan

Assignment/ Practical/Activity Number	Assignment / Practical/ Activity Title	Week Number/ Turn	Details	CLO	Hours
1	Practical 1:	Week 1	Create a SWI Prolog program to represent the family tree	CLO1	2
2	Practical 2:	Week 2	FACTORIAL, FIBONACCI SERIES AND PRIME NUMBER CHECKING Q1. Find whether a number N is prime or not Q2. Find factorial of a number N. Q3. Find Nth term of Fibonacci series	CLO1	2
3	Practical 3:	Week 3	Lists are important in Prolog. You will often need to pattern match against lists. Create a prolog file named Lab3_List_exercise.pl and create the following knowledge base.	CLO2	2
4	Practical 4:	Week 4/ Week 5	Eight queens problem is a constraint satisfaction problem (CSP). The task is to place eight queens in the 64 available squares in such a way that no queen attacks each other. So the problem can be formulated with variables x1, x2, x3, x4, x5, x6, x7, x8 and y1, y2, y3, y4, y5, y6, y7, y8.	CLO 2	4
5	Practical 5:	Week 6	The Tower of Hanoi puzzle in prolog	CLO3	2
6	Practical 6:	Week 7	WAP to Solve Travel salesman problem in prolog	CLO3	2
7	Practical 7:	Week 8	WAP to solve Water Jug in prolog	CLO4	2
8	Practical 8:	Week 9	WAP to solve Monkey Bannana Problem in prolog	CLO4	2
9	Practical 9:	Week 10	Write a program in PROLOG to implement factorial (N, F) where F represents the factorial of a number N.	CLO5	2
10	Practical 10:	Week 11/ Week 12	A prolog program will represent this expert knowledge in terms of rules in its knowledge base for Expert systems are computer applications which embody some non-algorithmic expertise for solving certain types of problems.	CLO5	4
11	Mini Project /Task	Week 13/14/15	Mini Project	CLO1/ 2/3/4/5	6
Total Hours					**30**

Learning resources

Text Books:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.
2. Artificial Intelligence, Kevin Knight, Elaine Rich, B. Shivashankar Nair, 3rd Edition,2008
3. Artificial Neural Networks B. Yagna Narayana, PHI.
4. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).

Reference Books:

1. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
2. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
3. Neural Networks Simon Haykin PHI.
4. 4. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition

Online Resources/ E learning Resource:

1. https://cyber.harvard.edu/topics/ethics-and-governance-ai
2. https://royalsocietypublishing.org/doi/full/10.1098/rsta.2018.0085
3. https://arxiv.org/abs/1812.02953

Name of the Program:	**M.TECH CSE(AI)**			**Semester : I**		**Level: PG**	
Course Name	**Machine Learning Techniques**			**Course Code/Course Type**		**PMTAI504**	
Course Pattern	**2024**			**Version**		**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	NA	NA	3	3	40	60	NA
Pre-Requisite: Knowledge of Analytics							
Course Objectives (CO):				**The objectives of ML are to:** 1. Comprehend the informed and uninformed problem types and apply search strategies to solve them. 2. Apply difficult real-life problems in a state space representation to solve those using MLtechniques like searching and game playing. 3. Design and evaluate intelligent expert models for perception and prediction from an intelligent environment. 4. Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision-making techniques. 5. Demonstrate and enrich knowledge to select and apply ML tools to synthesize information and develop models within constraints of the application area.			
Course Learning Outcomes (CLO):				**Students would be able to:** 1. Identify problems that are amenable to solution by specific ML methods 2. Represent knowledge in Prolog and write code for drawing inferences. 3. Identify appropriate ML technique for the problem at hand 4. Compare strengths and weaknesses of different artificial Intelligence techniques. 5. Sensitive towards development of responsible Machine Learning			

Course Contents

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias andVariance. Linear Regression: Introduction, Linear regression, Simple and Multiple Linear regression, Polynomial regression, evaluating regression fit.	**CLO 1**	**9**
UNIT II		
Decision tree learning: Introduction, Decision tree representation,appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive biasin decision tree learning, issues in decision tree learning, Python exercise on Decision Tree. Instance based Learning: K nearest neighbors, the Curse of Dimensionality, Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA. Recommender System: Content based system; Collaborative filtering based.	**CLO 2**	**9**
UNIT III		
Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression. Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem.	**CLO 3**	**9**
UNIT IV		
Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks, and the back propagation algorithm Ensembles: Introduction, Bagging and boosting, Random Forest, Discussion on some research papers. Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering.	**CLO 4**	**9**
UNIT V		
Expert System: Representing and using Domain Knowledge, Reasoning with knowledge, Expert System Shells, Support for explanation examples, Knowledge acquisition-examples.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Text Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020. Artificial Neural Networks B. Yagna Narayana, PHI.
3. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).

Reference Books:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007. Neural Networks Simon Haykin PHI.
3. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition

Online Resources/ E learning Resource

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs24/preview
3. https://sgfin.github.io/learning-resources/

Name of the Program:	M.TECH CSE(AI)	Semester: I	Level: PG
Course Name	Machine Learning Techniques Lab	Course Code/Course Type	PMTAI505
Course Pattern	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
NA	1	NA	1	2	25	-	25

Pre-Requisite: Knowledge of AI

Course Objectives (CO):	**The objectives of ML Lab are to:** 1. Understand the informed and uninformedproblem types and apply search strategies to solve them. 2. Apply difficult real-life problems in a state space representation to solve those using ML techniques like searching and game playing. 3. Design and evaluate intelligent expert models for perception and prediction from an intelligent environment. 4. Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques. 5. Demonstrate and enrich knowledge to select and apply ML tools to synthesize information and develop models within constraints of the application area.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify problems that are amenable to solution by specific ML methods 2. Represent knowledge in Prolog and write code for drawing inferences. 3. Identify appropriate ML technique for the problem at hand 4. Compare strengths and weaknesses of different artificial Intelligence techniques. 5. Sensitive towards development of responsible Machine Learning

Practical Plan

Assignment/ Practical/Activity Number	Assignment / Practical/ Activity Title	Week Number/Turn	Details	CLO	Hours
1	Practical 1:	Week 1	Basic exercises on Python Machine Learning Packages such as Numpy, Pandas and matplotlib.	CLO1	2
2	Practical 2:	Week 2	Given a dataset. Write a program to compute the Covariance, Correlation between a pair of attributes. Extend the program to compute the Covariance Matrix and Correlation Matrix.	CLO1	2
3	Practical 3:	Week 3	Given a set of sample points in N dimensional feature space. Write a program to fit the points with a hyper plane using Linear Regression. Calculate sum of residual error.	CLO2	2
4	Practical 4:	Week 4/ Week 5	Write a program that provides option to compute different distance measures between two points in the N dimensional feature space. Consider some sample datasets for computing distances among sample points.	CLO 2	4
5	Practical 5:	Week 6	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CLO3	2
6	Practical 6:	Week 7	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.	CLO3	2
7	Practical 7:	Week 8	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	CLO4	2
8	Practical 8:	Week 9	Given a dataset for classification task. Write a program to implement Support Vector	CLO4	2

			Machine and estimate it test performance.		
9	Practical 9:	Week 10	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	CLO5	2
10	Practical 10:	Week 11/ Week 12	Write a program to implement K means clustering algorithm. Select your own dataset to test the program. Demonstrate the nature of output with varying value of K.	CLO5	4
11	Mini Project /Task	Week 13/14/15	Mini Project	CLO1/ 2/3/4/5	6
Total Hours					**30**

Learning resources

Text Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020. Artificial Neural Networks B. Yagna Narayana, PHI.
3. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).

Reference Books:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007. Neural Networks Simon Haykin PHI.
3. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition

Online Resources/ E Learning Resource

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs24/preview
3. https://sgfin.github.io/learning-resources/

COURSE CURRICULUM

Course Contents/Syllabus:

(All the units carry equal weightage in Summative Assessment and equal engagement)

Name of the Program:		**M. TECH CSE (AI)**		**Semester: I**		**Level: PG**	
Course Name		**Seminar and Research Paper Writing I**		**Course Code/ Course Type**		**PMTAI507**	
Course Pattern		**2024**		**Version**		**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Self-Work**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
-	4	-	4	8	50	-	50
Pre-Requisite:							

Guidelines:

1. Individual student needs to study recent research topics in the field of Computer Engineering under the guidance of allocated guide.
2. Students can choose topic related to Computer Engineering considering recent trends and its societal importance and at least 5 latest research papers to be studied in seminar.
3. The extensive Literature Survey, Mathematical Modeling of particular method and valuable conclusion is expected from seminar study.
4. Seminar Report should be submitted as a compliance of term work associated with subject.
5. At least 1 review paper publication is expected as research outcome of seminar.
6. Total Duration: 24 Contact Hours and 24 Hours should be spent by students on completion of related activities and requirements.

Seminar Activities

Sr. No.	**Activity**	**Hours**
1.	Week 1, 2, 3: Guide allotment, finalization of topic, Planning of the work. Review-1 conduction	12
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, of detail topic.	12
3.	Week 6, 7, 8 : Detail Topic Mathematical model, methodology and findings Review-2 conduction	12
4.	Week 9, 10 : Comparison of detail topic with other existing methods	12
5.	Week 11, 12: Seminar Report writing and publication or copyright planning Final Review conduction.	12
	Total	**60**

Name of the Program:		MTECH CSE(AI)			Semester : I		Level: PG
Course Name		Advanced Python Programming			Course Code/ Course Type		PMTAI508
Course Pattern		2024			Version		1.0
Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. A course on "Data Science, GUI and Web Programming".
2. A course on "Python Programming".

Course Objectives (CO):	The objectives of Advanced Python Programming are:
	1. To access dataset using python. 2. To learn statistical analysis. 3. To learn how to visualizing result. 4. To develop the skill of designing Graphical user Interfaces. 5. To Develop Database Application.
Course Learning Outcomes (CLO):	**Students would be able to:**
	1. Manipulate and Analyze dataset. 2. Perform statistical analysis. 3. Demonstrate effectively visualizing result. 4. Develop the skill of designing Graphical user Interfaces. 5. Develop Database Application.

COURSE CURRICULUM

Course Contents/Syllabus:

Practical Plan

Assignment/Practical/Activity Number	Assignment/ Practical/Activity Title	Week Number/ Turn	Details	CLO	Hours
1	Practical 1:	Week 1, Week2	Create Regular Expressions that a) Recognize following strings bit, but, bat, hit, hat or hut b) Match any pair of words separated by a single space, that is, first and last names. c) Match any word and single letter separated by a comma and single space, as in last name, first initial. d) Match simple Web domain names that begin with www. and end with a ".com" suffix; for example, www.yahoo.com. Extra Credit: If your regex also supports other high-level domain names, such as .edu, .net, etc. (for example, www.foothill.edu). e) Match a street address according to your local format (keep your regex general enough to match any number of street words, including the type designation). For example, American street addresses use the format: 1180 Bordeaux Drive. Make your regex flexible enough to support multi-word street names such as: 3120 De la Cruz Boulevard.	CLO1	4
2	Practical 2:	Week3	Create Regular Expressions that: a) Extract the complete timestamps from each line. b) Extract the complete e-mail address from each line. c) Extract only the months from the timestamps. d) Extract only the years from the timestamps. e) Extract only the time (HH:MM:SS) from the timestamps.	CLO1	2
3	Practical 3:	Week 4	Write a multithread program to create 3 threads where one thread calculates the factorial and second thread calculates square and third thread calculates the summation of a list of numbers.	CLO1	2
4	Practical 4:	Week 5	Write a python program to create two threads to count how many lines in two text files (one thread will count lines from first file and other thread from second file).	CLO1	2
5	Practical 5:	Week 6	Write a python script that performs basic operations using MySQL database and a corresponding Python database adapter.	CLO5	2

6	Practical 6:	Week 7	Write a python script that performs basic operations using SQLite Database and acorresponding Python database adapter	CLO5	2
7	Practical 7:	Week 8,9	Write a program to demonstrate operations in Numpy	CLO2	4
8	Practical 8:	Week 10	Write a python program to demonstrate data indexing, selection and filtering in Pandas.	CLO3	2
9	Practical 9:	Week 11	Write a python program to create GUI application to illustrate slider tool that controls the size of the text font in the label widget.	CLO4	2
10	Practical 10:	Week 12	Write a python program to create GUI application to implement road signs with the appropriate foreground and background colors based on sign type stop, wait and Go signal.	CLO4	2
11	Practical 11:	Week 13,14	Write a python program to create a "Comments" or "Feedback" page for a Web site. Take user feedback via a form, process the data in your script, and return a "thank you" screen.	CLO3	4
12	Practical 12:	Week 15	Create a CGI application that not only saves files to the server's disk, but also displays the content of file back to the client.	CLO4	2
Total					**30**

Learning resources

Textbooks:

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson, 2012.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python”, O’Reilly, 2nd Edition, 2018.

Reference Books:

1. Wesley J. Chun, “Core Python Programming”, Prentice Hall, 2006
2. Mark Lutz, “Learning Python”, O’Reilly, 4th Edition, 2009
3. Elegant SciPy: The Art of Scientific Python By Nunez-Iglesias, Stefan van der Walt, Harriet Dashnow, O’Reilly Media.
4. A. Lukaszewski, MySQL for Python: Database Access Made Easy, Pact Publisher.

Online Resources/E-learning Resources:

1. https://www.w3schools.com/python/
2. https://python-iitk.vlabs.ac.in/List%20of%20experiments.html

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COURSE SYLLABUS MTECH CSE (AI) SEMESTER-II

COURSE CURRICULUM

Course Contents/Syllabus:

Name of the Program:	**MTECH CSE(AI)**			**Semester : II**		**Level: PG**	
Course Name	**Deep Learning Techniques**			**Course Code/ Course Type**		**PMTAI509**	
Course Pattern	**2024**			**Version**		**1.0**	
Teaching Scheme				**Assessment Scheme**			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Basics of Machine Learning
2. Python Programming Language
3. Basics of Probability

Course Objectives (CO):	**The objectives of Deep Learning Techniques are:** 1. To learn the concept of Deep Learning and its application 2. To introduce the idea of Convolutional neural networks and their architecture 3. To introduce techniques used for training artificial neural networks 4. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. 5. To enable design and deployment of deep learning models for machine learning problems
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend the mathematics behind functioning of artificial neural networks and CNN. 2. Analyze the given dataset for designing a neural network-based solution 3. Design and implementation of deep learning models for signal/image processing applications 4. Design and deploy simple TensorFlow-based deep learning solutions to classification problems 5. Implement deep learning algorithms and solve real-world problems.

Descriptors/Topics	CLO	Hours
UNIT I Understanding Deep Learning and its application:		
Understanding Deep Learning and its application: Introduction to Deep Learning (DL), DL Applications in various domains, Supervised and unsupervised learning, Model training, overfitting, model deployment, inferencing. **Convolutional Neural Networks (CNN):** Introduction to Deep Supervised Learning, Convolution & Pooling, Dropout, LeNet, AlexNet, ZFNet, VGGNet, GoogleNet, ResNet, DenseNet and other State-of-the-art CNNs.	**CLO 1**	**9**
UNIT II Text representations and embeddings:		
Text representations and embeddings: Transfer Learning: Transfer Learning Scenarios, Applications of Transfer Learning, Transfer Learning Methods, Fine Tuning and Data Augmentation, Related Research Areas. **CNN for Computer Vision:** Image Classification and Localization, Object Detection, Semantic Segmentation, Instance Segmentation	**CLO 2**	**9**
UNIT III		
Applications of Recurrent and Recursive Neural Networks: Understanding Recurrent and Recursive Neural Networks, Word Embedding, Language Models, Text Classification, Named Entity Recognition, Machine Translation, Parsing, Sentiment Analysis, Speech Recognition ,Encoder Decoder architectures, Attention Model, Transformer, BERT, ChatGPT	**CLO 3**	**9**
UNIT IV		
Reinforcement Learning: Introduction, Markovian Decision Process, Q Learning, Deep Q Learning	**CLO 4**	**9**
UNIT V		
Generative Network: Understanding Generative Adversarial Networks, Image Inpainting, Image Super Resolution, Colorization of Black and White Images, Human Face Generation, Text2Image	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press
2. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.
3. Francois Chollet, Deep Learning with Python, Manning Publications

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, http://www.deeplearningbook.org. MIT Press, 2016.
2. Bengio, Yoshua. Learning deep architectures for AI (Foundations and trends in Machine Learning)

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs11/preview Deep Learning By Prof. Prabir Kumar Biswas | IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc24_cs59/preview By Prof. Sudarshan Iyengar, Prof. Padmavati | IIT Ropar, Punjab Engineering College (Deemed to be University)

COURSE CURRICULUM

Name of the Program:	**MTECH CSE (AI)**			**Semester : 2**		**Level: PG**	
Course Name	**Deep Learning Techniques Lab.**			**Course Code/ Course Type**		**PMTAI510**	
Course Pattern	**2024**			**Version**		1.0	
Teaching Scheme				**Assessment Scheme**			
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basics of Machine Learning
2. Python Programming Language
3. Basics of Probability

Course Objectives (CO):	**The objectives of Deep Learning Techniques are:** 1. To learn the concept of Deep Learning and its application 2. To introduce the idea of Convolutional neural networks and their architecture 3. To introduce techniques used for training artificial neural networks 4. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. 5. To enable design and deployment of deep learning models for machine learning problems
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend the mathematics behind functioning of artificial neural networks and CNN. 2. Analyze the given dataset for designing a neural network-based solution 3. Design and implementation of deep learning models for signal/image processing applications 4. Design and deploy simple TensorFlow-based deep learning solutions to classification problems 5. Implement deep learning algorithms and solve real-world problems.

Course Contents/Syllabus:

Practical Plan

Assignment/Practical/Activity Number	Assignment/ Practical/Activity Title	Week Number/ Turn	Details	CLO	Hours
1.	Practical 1:	Week 1,	Write a program to convert text into speech.	CLO1	2
2.	Practical 2:	Week2,	Write a program to convert video into frames.	CLO2	2
3.	Practical 3:	Week3	Write a program for character recognition using CNN.	CLO1, CLO3	2
4.	Practical 4:	Week 4,	Build a feed forward neural network for prediction of logic gates.	CLO3	2
5.	Practical 5:	Week5,	Write a program to predict a caption for a sample image using CNN.	CLO1, CLO3	2
6.	Practical 6	Week6	Write a program for object detection using image labeling tools.	CLO4 CLO5	2
7.	Practical 7	Week 7,	Write a program for Time-Series Forecasting with the LSTM Model.	CLO4	2
8.	Practical 8	Week 8,	Write a program to implement deep learning Techniques for image segmentation.	CLO4	2
9.	Practical 9	Week 9	Write a program to detect Dog image using YOLO Algorithm.	CLO4	2
10.	Practical 10	Week 10,	Write a program to develop Auto encoders using MNIST Handwritten Digits.	CLO5	2
11.	Practical 11	Week 11, Week 12	Write a program to develop a GAN for Generating MNIST Handwritten Digits.	CLO5	2
12.	Mini Project	Week13	Mini Project	CLO5	2
13.	Mini Project	Week 14	Mini Project	CLO5	3
14.	Mini Project	Week15	Mini Project	CLO5	3
Total					**30**

Learning resources

Textbooks:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press
2. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.
3. Francois Chollet, Deep Learning with Python, Manning Publications

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, http://www.deeplearningbook.org. MIT Press, 2016.
2. Bengio, Yoshua. Learning deep architectures for AI (Foundations and trends in Machine Learning)

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs11/preview Deep Learning By Prof. Prabir Kumar Biswas | IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc24_cs59/preview By Prof. Sudarshan Iyengar, Prof. Padmavati | IIT Ropar, Punjab Engineering College (Deemed to be University)

COURSE CURRICULUM

Name of the Program:		**MTECH CSE (AI)**			**Semester : 2**	**Level: PG**	
Course Name		**Natural Language Processing**			**Course Code/ Course Type**	**PMTAI511**	
Course Pattern		**2024**			**Version**	**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	NA	NA	3	3	40	60	NA

Pre-Requisite:

1. Basics of Machine Learning
2. Python Programming Language
3. Basics of Probability

Course Objectives (CO):	**The objectives of NLP are to:**
	1. Comprehend leading trends and systems in natural language processing. 2. Describe concepts of morphology, syntax, semantics, and pragmatics of the language. 3. Comprehend Language Models and their evaluation. 4. Writing programs in Python to carry out natural language processing. 5. Implement deep learning algorithms in Python and learn how to train deep networks for NLP applications.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Explain processes and representations used in syntax, semantics, and other components of natural language processing. 2. Use machine learning and deep learning algorithms for Natural Language Processing applications. 3. Explore the models used for word/sentence representations for various NLP applications. 4. Use the tools for performing text analytics in a variety of contexts. 5. Apply the different Feature Extraction and Embedding's processes

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction - terminologies -basic techniques in natural language processing, including tokenization, part-of-speech tagging, chunking, syntax parsing, Dependency parsing, named entity recognition, Co-reference Resolution Word-sense Disambiguation.	**CLO 1**	**9**
UNIT II		
Text representations and embeddings: One-hot encoding, Bag-of-Words (BoW) Dictionary: Term Frequency – Inverse Document Frequency (TF IDF), N-gram. Introduction to various nlp toolkits such as nltk, Spacy etc.	**CLO 2**	**9**
UNIT III		
Neural Networks Basics:- Feed forward Neural Network, Recurrent Neural Networks, LSTM, An Introduction to Transformers and Sequence-to-Sequence Learning. Neural Networks for NLP – Vector Representation of words – Contextual Understanding of text – Co-occurrence of matrix – N-grams – Dense Word Vector.	**CLO 3**	**9**
UNIT IV		
Feature Extraction and Embeddings Word2Vec – CBOW and Skip-gram Models – One-word learning architectureForward pass for Word2Vec – Reduction of complexity – sub-sampling and negative sampling. Continuous Skip-Gram Model, GloVe, BERT,XLNet.	**CLO 4**	**9**
UNIT V		
NLP Challenges Word sense Disambiguation NER. Named Entity Recognition, Sentiment analysis, Text categorization: Basic supervised text categorization algorithms, including Naive Bayes, k Nearest Neighbour (kNN) and Logistic Regression.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. C.D. Manning et al, "Foundations of Statistical Natural Language Processing," MitPress. MIT Press, 1999. isbn: 9780262133609.
2. James Allen, "Natural Language Processing with Python", O'Reilly Media, July 2009.

Reference Books:

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition," 1st. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2000. isbn: 0130950696.
2. Jacob Perkins, "Python 3 text processing with NLTK 3 cookbook," Packet Publishing Ltd, 2014.
3. Ian Goodfellow, YoshuaBengio, and Aaron Courville, Deep Learning, http://www.deeplearningbook.org. MIT Press, 2016.

Online Resources/E-learning Resources:

1. Natural Language Toolkit nltk.org

COURSE CURRICULUM

Name of the Program:	**MTECH CSE (AI)**				**Semester : 2**	**Level: PG**	
Course Name	**Natural Language Processing Lab**				**Course Code/ Course Type**	**PMTAI512**	
Course Pattern	**2024**				**Version**	**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Data Structures
2. Python / R Programming

Course Objectives (CO):	**The objectives of NLP Lab are:** 1. To provide practical knowledge of language processing that involves various operations that can be performed on text data. 2. To familiarize with fundamental topics in language processing that include tokenization, stemming, tagging, classification, and information extraction using Python programs. 3. To facilitate understanding of regular expressions, formal grammar that describe the structure of an unlimited set of sentences. 4. To create classifiers and choose the best classifier. 5. To perform NLP operations on existing corpora and build simple AI Applications.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Apply the concept of natural language processing (NLP) using Natural Language Toolkit (NLTK). 2. Build text corpora with tokenization, Stemming, Lemmatization, 3. Apply visualization techniques. 4. Evaluate the classifiers and choose the best classifier. 5. Use different libraries for NLP Applications

Course Contents/Syllabus:

Practical Plan

Assignment/Practical/Activity Number	Assignment/Practical/Activity Title	Week Number/ Turn	Details	CLO	Hours
1	Practical 1:	Week 1, Week2, Week3	Perform Automatic, N-gram and Transformation based Tagging for text data.	CLO1	6
2	Practical 2:	Week 4, Week5, Week6	Write a program to demonstrate Mapping Words to Properties Using Python Dictionaries	CLO2	6
3	Practical 3:	Week 7, Week8, Week9	Implement Chabot.	CLO3	6
4	Practical 4:	Week 10, Week 11, Week12	Perform Tokenization, Stemming, and Lemmatization to carry out the analysis with text corpora.	CLO4	6
5	Practical 5:	Week 13, Week14, Week15	Perform Classification of product reviews on ecommerce websites	CLO5	6
Total					**30**

Learning resources

Textbooks:

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson, 2012.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python”, O’Reilly, 2nd Edition, 2018.

Reference Books:

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2nd Edition, Pearson Education, 2009.
2. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, 2ndEdition, Chapman and Hall/CRC Press, 2010.
3. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
4. Nitin Hardaniya, Jacob Perkins, ―Natural Language Processing: Python and NLTK‖, Packt Publishers, 2016.

Online Resources/E-learning Resources:

1. https://nltk.org
2. https://nlp-iiith.vlabs.ac.in/

COURSE CURRICULUM

Name of the Program:	**M.Tech CSE (AI)**	**Semester : II**	**Level: PG**
Course Name	**Advanced Statistical Techniques**	**Course Code/ Course Type**	**PMTAI513**
Course Pattern	**2024**	**Version**	**1.0**

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
3	0	0	3	3	40	60	-

Prerequisite: Basic statistical concepts.

Course Objectives (CO):	**The objectives of (Advanced Statistical Techniques) are:** 1. To familiarize the students with advanced techniques in Statistics 2. To acquire knowledge of techniques of advanced level of sampling & estimation 3. To apply tests of hypothetical techniques and its applications that would enhance analytical thinking power. 4. To comprehend the where and how to apply parametric & non parametric tests with applications. 5. To comprehend various hypothesis tests.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Students will be able to identify the advanced terms in statistics. 2. Explain the estimation & its techniques. 3. Apply knowledge of hypothesis techniques to test large and small samples. 4. Learn & apply non parametric tests on practical situations. 5. Apply various hypothesis test in real time environment.

Course Contents/Syllabus:

Descriptors/Topics	**CLO**	**Hours**
UNIT I Basic Statistical Concepts		
Introduction Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Multiple Correlation, Linear and Multiple egression, Reliability of Regression Estimates.	**CLO 1**	**9**

UNIT II Sampling Techniques		
Random sampling, Sampling from finite and infinite populations, with and without replacement, central limit theorem, Standard error of sampling, Sampling distribution of sample mean and proportion, stratified random sampling.	**CLO 2**	**9**
UNIT III Estimation		
Introduction, Types of estimation, Interval estimation, Point estimation: Maximum likelihood function, Method of moments, Criteria for good estimates: Unbiasedness, Consistency, Sufficiency by Neyman factorization theorem and Efficiency, their applications in estimation.	**CLO 3**	**9**
UNIT IV Test of Hypothesis-I		
Introduction, Hypothesis, Simple and composite hypothesis, Type I and Type II errors, Level of significance, Critical region, Student's-t test, Z-test	**CLO 4**	**9**
UNIT V Test of Hypothesis-II		
Test of hypothesis for small & large sample by Chi-Square distribution, Student's-t distributions, F-distributions. Degree of freedom, Analysis of variance (ANOVA): one-way, two-way (without interactions), P-Value.	**CLO 5**	**9**
Total Hours		**45**

Learning resources

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2014.
2. Hugh Neill, Trigonometry: A complete Introduction, John Murray Learning, 2018.
3. George B. Thomas, Jr and Ross L. Finney, Calculus and Analytic Geometry, 9th Edition, 1998

Reference Book(s):

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2010.
2. Ron Larson, Trigonometry, Brooks/Cole, 9th Edition, 2013.
3. Robert E, Moyer, Trigonometry, Mc. Graw Hill, Addision-Wesely, 4th Edition, 2009.

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COURSE CURRICULUM

Name of the Program:	**M.TECH CSE-AI**				**Semester: II**	**Level: PG**	
Course Name	**Generative AI**				**Course Code/Course Type**	**PMTAI514 A**	
Course Pattern	**2024**				**Version**	1.0	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
2	NA	1	3	3	40	60	NA

Pre-Requisite:
1. Machine Learning Fundamentals
2. Neural Network.

Course Objectives (CO):	**The objective of Generative AI is to:** 1. Comprehend Generative Models 2. Explore various applications of generative models including image generation, text generation, and data augmentation. 3. Explore various applications of generative models including image generation, text generation, and data augmentation. 4. Apply learned concepts through hands-on projects involving the implementation of generative models using popular frameworks like TensorFlow or PyTorch. 5. Experiment with training generative models on different datasets and fine-tuning hyper parameters
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyse appropriate applications of generative AI in specific business contexts, including benefits, value, challenges, decision-making, and so on 2. articulate the steps to apply generative AI in your context, identifying the key considerations and decisions required at each step 3. identify and evaluate risks surrounding the use of AI in a business context 4. design a people-centered process for the application of generative AI in an organization 5. Evaluate the potential application of future AI developments for a specific organization and/or industry.

Descriptors/Topics	CLO	Hours
UNIT I		
Generative AI: How does Generative AI work, Use Cases of Generative AI, what is Non-Generative AI, What is Non-Generative AI, Advantages of Non-Generative AI, Disadvantages of Non-Generative AI, Difference in Output Between Generative and Non-Generative AI, Difference in Output Between Generative and Non-Generative AI, Applications of Non-Generative AI, Applications of Non-Generative AI. Image Synthesis, Text Generation, Creative Design, Music Composition, Data Augmentation, Drug Discovery.	**CLO 1**	**9**
UNIT II		
Understanding Text Data: Importance of Text Data in AI, Types of Text Data, Structured Text Data, Unstructured Text Data, Semi-Structured Text Data, Text Data Processing for Structured Text, Text Data Processing for Unstructured Text, Text Data Processing for Semi-Structured Text, Creating Textual Content, Improving Semantic Understanding, Enhancing the Decision-Making Process.	**CLO 2**	**9**
UNIT III		
AI for Image Generation: Applications of Image Generation, Overview of Generative Adversarial Networks, Overview of Generative Adversarial Networks, Diffusion Models for Image Generation, Diffusion Models for Image Generation, Origin of Stable Diffusion, Training Data of Stable Diffusion Models, Workings of Stable Diffusion Models, Stable Diffusion Platforms. Evaluating Prompts: An Overview: Prompt engineering and evaluation, Approaches for Evaluating Prompts, Examples of Prompt Evaluation Techniques, Strategies for Effective Evaluation, Role of Context Sensitivity in Prompt Evaluation, Evaluation Strategies for Different Audiences.	**CLO 3**	**9**
UNIT IV		
Overview of Enterprise AI: Significance of Enterprise AI, Core Elements of Enterprise AI, Role of Enterprise AI in Different Business Departments, Benefits of Enterprise AI, Benefits of Enterprise AI, Real-world Examples of Enterprise AI, Real-world Examples ofEnterprise AI, Differentiation between AI, Regular AI, and Enterprise AI, Understanding Regular AI, Advantages of Regular AI, Strengths and Limitations of Regular AI, Main Differences between Regular AI and Enterprise AI, Main Differences between Regular AIand Enterprise AI, Main Differences between Regular AI and Enterprise AI, Main Differences between Regular AI and Enterprise AI, Main Differences between Regular AI and Enterprise AI, Importance of Adapting to Enterprise AI.	**CLO 4**	**9**
UNIT V		
The Evolution of Generative AI: The Impact of Generative AI on Various Sectors, The Impact of Generative AI on Various Sectors, Trends in Generative AI, Trends in Generative AI: AI Enabling Creativity, Trends in Generative AI: Enhanced Personalization, Trends in Generative AI: Advancements in Gans, Trends in Generative AI: Conversational AI, Trends in Generative AI: Strengthened AI infrastructure, Trends in Generative AI: Scientific Research, Trends in Generative AI: NLP Applications.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Learn Python Generative AI: Journey from autoencoders to transformers to large language models Paperback – Import, 31 January 2024
2. The Potential of Generative AI: Transforming technology, business and art through innovative AI applications Paperback – Import, 10 February 2024

3. Generative AI for everyone: Understanding the essentials and applications of this breakthrough technology. Kindle Edition by Altaf Rehmani (Author) Format: Kindle Edition.

Reference Books:

1. "Generative Deep Learning" by David Foster": A comprehensive guide that delves into the principles of generative models, covering topics from autoencoders to variational autoencoders and GANs.
2. "Grokking Deep Learning" by Andrew W. Trask: Aimed at beginners, this book provides a clear and accessible introduction to deep learning, including generative models and their applications.
3. "Hands-On Generative Adversarial Networks with Keras" by Rajalingappaa Shanmugamani: A practical guide that walks readers through the implementation of GANs using Keras, making it an bb
4. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Often referred to as the "Bible of Deep Learning," this comprehensive book covers the fundamentals, making it indispensable for understanding generative models.

Online Resources:

1. https://aws.amazon.com/ai/generative-ai/
2. https://www.blockchain-council.org/certifications/certified-generative-ai-expert/

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COURSE CURRICULUM

Name of the Program:		**M.TECH CSE-AI**			**Semester: II**	**Level: PG**	
Course Name		**Explainable AI**			**Course Code/Course Type**	**PMTAI514 B**	
Course Pattern		**2024**			**Version**	**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
2	NA	1	3	3	40	60	NA

Pre-Requisite:

1. Basic knowledge of machine learning algorithms and techniques.
2. Familiarity with Python programming language and relevant libraries (e.g., NumPy, pandas).

Course Objectives (CO):	**The objective of Explainable AI is to:** 1. Understand the importance of explainability in AI and its impact on stakeholders. 2. Explore different techniques and methods for making AI systems explainable. 3. Analyze the trade-offs between model complexity and interpretability. 4. Examine the ethical and societal implications of XAI. 5. Apply XAI techniques to real-world datasets and scenarios.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understanding of Explainable AI Concepts 2. Knowledge of XAI Techniques 3. Ability to Apply XAI Methods 4. Critical Evaluation of XAI 5. Ethical and Societal Awareness:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Explainable AI (XAI): Motivations for XAI Importance of interpretability and transparency Techniques for XAI, Model-specific interpretability methods (e.g., decision trees, rule- based systems) Model-agnostic interpretability methods (e.g., LIME, SHAP) Post-hoc explanation techniques (e.g., feature importance, counterfactual explanation.	**CLO 1**	**9**
UNIT II		
Interpretable Models: Linear models, Decision trees and rule-based systems Symbolic AI approaches, Interpretable Neural Networks, Sparse neural networks, Attention mechanisms, Layer-wise relevance propagation (LRP)	**CLO 2**	**9**
UNIT III		
Evaluation of XAI Methods: Quantitative metrics for interpretability, Human-centric evaluation methods, Ethical and Societal Implications of XAIB, is and fairness in interpretable AI, Trust and accountability in AI systems ,Regulatory considerations.	**CLO 3**	**9**
UNIT IV		
Evaluation of XAI Methods: Quantitative metrics for interpretability Human-centric evaluation methods, Ethical and Societal Implications of XAI Bias and fairness in interpretable AI, Trust and accountability in AI systems Regulatory considerations.	**CLO 4**	**9**
UNIT V		
Applications of XAI: Healthcare (e.g., medical diagnosis, personalized treatment) Finance (e.g., credit scoring, fraud detection), Autonomous systems (e.g., self-driving cars, drones).	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. "Interpretable Machine Learning" by Christoph Molnar
2. "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning" by L. Liu and G. Hu
3. Research papers and articles from relevant conferences and journals (e.g., NeurIPS, ICML, AAAI)

Reference Books:

1. "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable" by Christoph Molnar
2. "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning" by L. Liu and G. Hu –
3. "Explainable AI in Healthcare: Exploring Interpretable Models and Learning from Patient Data" edited by F. E. Elsayed and B. G. Stoecklin

Online Resources:

1. https://christophm.github.io/interpretable-ml-book/

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COURSE CURRICULUM

Name of the Program:		**M.TECH CSE-AI**			**Semester: II**	**Level: PG**	
Course Name		**Data Visualization Techniques**			**Course Code/Course Type**	**PMTAI515**	
Course Pattern		**2024**			**Version**	**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Tutorial**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
NA	2	NA	2	4	25	NA	25

Pre-Requisite:

1. Basic knowledge of machine learning algorithms and techniques.
2. Familiarity with Python programming language and relevant libraries (e.g., NumPy, pandas).

Course Objectives (CO):	**The objective of Data Visualization Techniques AI:** 1. Understand the importance of Data Visualization. 2. Explore different techniques and methods for Data Visualization. 3. Analyze the time series data. 4. Examine the multivariate data using various methods. 5. Apply data visualization to develop a dashboard.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understanding data visualization Concepts 2. Knowledge of data visualization Techniques 3. Ability to Apply data visualization Methods 4. Critical Evaluation of data visualization. 5. Application development using data visualization.

Course Contents/Syllabus:

Practical Plan

Assignment/Practical/Activity Number	**Assignment/ Practical/Activity Title**	**Week Number/ Turn**	**Details**	**CLO**	**Hours**
1	Practical 1:	Week 1, Week2	Introduction to Data Visualization • Overview of data visualizationprinciples • Importance of visualization in dataanalysis	CLO1	8

			• Types of data and appropriatevisualizations		
2	Practical 2:	Week3	Data Visualization Tools • Introduction to tools like: • Python: matplotlib, seaborn • R: ggplot2, plotly • Tableau: Basics of creatingvisualizations	CLO1	4
3	Practical 3:	Week 4	Design Principles • Gestalt principles of visual perception • Color theory and its application invisualizations • Layout and composition in datavisualization	CLO1	4
4	Practical 4:	Week 5	Exploratory Data Analysis (EDA) • Using visualizations for EDA • Handling missing data and outliersvisually • Interactive visualizations for EDA	CLO1	4
5	Practical 5:	Week 6	Static Visualizations • Creating bar charts, histograms, scatterplots • Box plots and violin plots • Advanced techniques: heatmaps,mosaic plots	CLO5	4
6	Practical 6:	Week 7	Dynamic and Interactive Visualizations • Introduction to interactive plottinglibraries • Creating interactive dashboards • Adding interactivity to visualizations	CLO5	4
7	Practical 7:	Week 8,9	Geographic and Temporal Data Visualization • Mapping techniques and tools (e.g.,Leaflet, GeoPandas) • Visualizing temporal data (time series,timelines)	CLO2	8
8	Practical 8:	Week 10	Special Topics in Data Visualization • Network visualization • Text and sentiment visualization • Advanced chart types (e.g., Sankeydiagrams, radar charts)	CLO3	4
9	Practical 9:	Week 11	Ethics and Storytelling through DataVisualization • Ethical considerations in visualization • Telling compelling stories with data • Communicating uncertainty andavoiding	CLO4	4

10	Practical 10:	Week 12	Mini Project • Students choose a dataset and design a comprehensive visualization project • Includes a written report explaining design choices and insights gained	CLO 4	4
11	Practical 11:	Week 13,14	Mini Project	CLO 3	8
12	Practical 12:	Week 15	Mini Project	CLO 4	4
Total					**60**

Learning resources

Text Books:

1. Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.
2. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021

Reference Books:

1. Dr. Chun-hauh Chen, W. K. Hardle, A. Unwin, Handbook of Data Visualization, 1st edition, Springer publication, Germany, 2008.
2. Ben Fry, Visualizing Data, 1st edition, O'Reilly Media, United States, 2008.
3. Avril Coghlan, A little book of R for multivariate analysis, 1st edition, Welcome Trust Sanger Institute, United Kingdom, 2013.

Online Resources/ E learning Resource

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs24/preview
3. https://sgfin.github.io/learning-resources/

COURSE CURRICULUM

Name of the Program:	**M. TECH CSE (AI)**	**Semester: II**	**Level: PG**
Course Name	**Seminar and Research Paper Writing II**	**Course Code/ Course Type**	**PMTAI516**
Course Pattern	**2024**	**Version**	**1.0**

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Self-Work**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/ Oral**
-	4	-	4	8	50	-	50

Pre-Requisite:

Guidelines:

1. Individual student needs to study recent research topics in the field of Computer Engineering under the guidance of allocated guide.
2. Students can choose topic related to Computer Engineering considering recent trends and its societal importance and at least 5 latest research papers to be studied in seminar.
3. The extensive Literature Survey, Mathematical Modeling of particular method and valuable conclusion is expected from seminar study.
4. Seminar Report should be submitted as a compliance of term work associated with subject.
5. At least 1 review paper publication is expected as research outcome of seminar.
6. Total Duration: 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

Detailed Syllabus:

Seminar Activities

Sr. No.	**Activity**	**Hours**
1.	Week 1, 2, 3: Guide allotment, finalization of topic, Planning of the work. Review-1 conduction	24
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, of detail topic.	24
3.	Week 6, 7, 8 : Detail Topic Mathematical model, methodology and findings Review-2 conduction	24
4.	Week 9, 10 : Comparison of detail topic with other existing methods	24
5.	Week 11, 12: Seminar Report writing and publication or copyright planning Final Review conduction.	24
	Total	**120**

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COURSE SYLLABUS
MTECH CSE (AI)
SEMESTER-III

Name of the Program:		**M. TECH CSE (AI)**		**Semester: III**		**Level: PG**	
Course Name		**Project Phase I**		**Course Code/ Course Type**		**PMTAI603**	
Course Pattern		**2024**		**Version**		**1.0**	
Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Self-Work**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
-	10	-	10	20	200	-	200

Pre-Requisite: 1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python.

Course Objectives (CO):	**The objective of Project Phase I is to:** 1. To comprehend the —Product Development Process. 2. To plan for various activities of the major project and channelize the work towards product development. 3. To build, design and implement real time application using available platforms. 4. To inculcate research culture in students for their technical growth
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend, plan and execute the major Project with appreciable research outcomes. 2. Design real time application considering immerging areas in technology 3. Prepare good quality technical report based on the project. 4. Demonstrate technical ideas and its relevance in recent technology 5. Publish good quality paper in reputed journal and present their work in reputed conferences.

Guidelines:

1. Individual student need to design and demonstrate project under the guidance of allocated guide.
2. Sponsored Project or Project Internship is acceptable considering postgraduate scope.
3. Students can choose project domain and problem statement as per latest research areas, recent technology trends and societal importance.
4. Project Report-1 should be submitted as a compliance of term work associated with subject.
5. At least 2 Paper publications are expected as research outcome of Project Stage-I (Scopus

indexed Conference or Journal) and 40% of planned project work should be completed for submission of Dissertation Phase-I

6. Total Duration: 120 hours are contact hours with guides and for reviews, 120 hours are expected to be spend by students to satisfy all project requirements and implementations.

Detailed Syllabus:

Project Phase – I [Company/ In-house project]

Sr. No.	Activity	Hours
1.	Week 1, 2, 3: Guide allotment, applying for sponsorship and project internship, finalization of topic and platform, Planning of the work.	60
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, Review 1 for finalization of topic and specification.	60
3.	Week 6, 7, 8 : understanding platform implementation and related software flow and execute block level design , Review 2 to understand the progress of the project	60
4.	Week 9, 10 : Simulation of proposed methodology on appropriate software tools and finalization of hardware platform	60
5.	Week 11, 12: Project Report writing and publication or copyright planning and execution. Demonstration of Project work and Final Review for submission and term work compliances	60
	Total	**300**

Name of the Program:	M. TECH CSE (AI)	Semester: III	Level: PG
Course Name	Internship	Course Code/ Course Type	PMTAI604
Course Pattern	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Self-Work	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
-	6	-	6	12	50	-	50

Guidelines:

Student can take internship work in the form of Online/Onsite mode from any of the following but not limited to:

1. Industry / Government Organization Internship.
2. Eduskills, Internshala, ByteXL (Platinum Placement) etc.
3. Research internship under Professors (Internal and External), IISC, IIT's, NIT's and other Research organizations.
4. Participate in open-source contribution.
5. Any other with the permission of faculty mentor.

Internship Progress Monitoring:

Internship Process Flow:

1. Internship opportunity will be provided by 3 ways- Through Training & Placement Cell, Through Department/Faculty and searched by own [students].
2. Internship opportunity will be provided by 3 ways- Through Training & Placement Cell, Through Department/Faculty/Searched by own (Students).
3. The student has to take permission from faculty mentor and internship coordinator to verify quality of internship.
4. Student has to submit the Internship offer letter or official mail communication proof to internship coordinator.
5. After permission the student needs to start the Internship program.
6. The intern student must report about the Internship program to faculty mentor.
7. At the end of the Internship program, student should submit completion certificate from industry and report.
8. At the end of the Internship program, student should submit completion certificate from industry and report.

Internship Work Evaluation:

1. Students will be allotted to faculty mentors.
2. Students will be allowed to do internship at the end of 6th semester and till the commencement of 7th semester.
3. Students will do internship for minimum of 4-weeks (40-45 hours/week) through which they can earn 3 credits.
4. If students are in summer term, then they have to manage their time for summer term academic activities (if any) and internship.

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COURSE SYLLABUS
MTECH CSE (AI)
SEMESTER-IV

Name of the Program:	**M. TECH CSE (AI)**	**Semester: IV**	**Level: PG**
Course Name	**Project Phase II**	**Course Code/ Course Type**	**PMTAI605**
Course Pattern	**2024**	**Version**	**1.0**

Teaching Scheme					**Assessment Scheme**		
Theory	**Practical**	**Self-Work**	**Total Credits**	**Hours**	**CIA (Continuous Internal Assessment)**	**ESA (End Semester Assessment)**	**Practical/Oral**
-	10	-	10	20	300	-	300

Pre-Requisite:
1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python.

Course Objectives (CO):	**The objective of Project Phase II is to:** 1. To comprehend the ―Product Development Process. 2. To plan for various activities of the major project and channelize the work towards product development. 3. To build, design and implement real time application using available platforms. 4. To inculcate research culture in students for their technical growth
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend, plan and execute the major Project with appreciable research outcomes. 2. Design real time application considering immerging areas in technology 3. Prepare good quality technical report based on the project. 4. Demonstrate technical ideas and its relevance in recent technology 5. Publish good quality paper in reputed journal and present their work in reputed conferences.

Project Phase – II [Company/ In-house project]		
Sr. No.	**Activity**	**Hours**
1.	Week 1, 2, 3: Guide allotment, applying for sponsorship and project internship, finalization of topic and platform, Planning of the work.	60
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, Review 1 for finalization of topic and specification.	60
3.	Week 6, 7, 8 : understanding platform implementation and related software flow and execute block level design , Review 2 to understand the progress of the project	60
4.	Week 9, 10 : Simulation of proposed methodology on appropriate software tools and finalization of hardware platform	60
5.	Week 11, 12: Project Report writing and publication or copyright planning and execution. Demonstration of Project work and Final Review for submission and term work compliances	60
	Total	**300**

COURSE CURRICULUM

Course Contents/Syllabus:

(All the units carry equal weightage in Summative Assessment and equal engagement)

Sr. No.	Activity	Hours

Name of the Program:	M. TECH CSE (AI)	Semester: IV	Level: PG
Course Name	Seminar	Course Code/ Course Type	PMTAI606
Course Pattern	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Self-Work	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/Oral
	6	-	6	12	50	-	50

Pre-Requisite:

Guidelines:

1. Individual student needs to study recent research topics in the field of Computer Engineering under the guidance of allocated guide.
2. Students can choose topic related to Computer Engineering considering recent trends and its societal importance and at least 5 latest research papers to be studied in seminar.
3. The extensive Literature Survey, Mathematical Modeling of particular method and valuable conclusion is expected from seminar study.
4. Seminar Report should be submitted as a compliance of term work associated with subject.
5. At least 1 review paper publication is expected as research outcome of seminar.
6. Total Duration: 24 Contact Hours and 24 Hours should be spend by students on completion of related activities and requirements.

Detailed Syllabus:

Seminar Activities		
1.	Week 1, 2, 3: Guide allotment, finalization of topic, Planning of the work. Review-1 conduction	36
2.	Week 4, 5: Literature review, Specification and Methodology Finalization, of detail topic.	36
3.	Week 6, 7, 8 : Detail Topic Mathematical model, methodology and findings Review-2 conduction	36
4.	Week 9, 10 : Comparison of detail topic with other existing methods	36
5.	Week 11, 12: Seminar Report writing and publication or copyright planning Final Review conduction.	36
	Total	**180**

Suggested MOOC Courses List

1. **Machine Learning Techniques and Applications by Duke University**
2. **Generative AI Fundamentals by IBM**
3. **Generative AI with Large Language Models by AWS, DeepLearning.AI**
4. **Neural Networks and Deep Learning by DeepLearning.AI**
5. **Improving Deep Neural Networks by DeepLearning.AI**
6. **Natural Language Processing by DeepLearning.AI**
7. **Applied AI with DeepLearning by IBM**
8. **Rust for Large Language Model Operations (LLMOps) by Duke University**
9. **Project Management Certification by Google**

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Course Name	University / Industry Partner Name	Learning Hours-by instructor	Course Rating	Course URL
Basic Mathematics	Birla Institute of Technology & Science, Pilani	54	4.5	https://www.coursera.org/video/basicmathematics
Interpersonal Communication for Engineering Leaders	Rice University	22	4.7	https://www.coursera.org/learn/interpersonal-communication
Oral Communication for Engineering Leaders	Rice University	24	4.6	https://www.coursera.org/learn/oral-communication
Writing Skills for Engineering Leaders	Rice University	17	4.7	https://www.coursera.org/learn/engineering-writing
Object Oriented Programming in Java	University of California San Diego	39	4.7	https://www.coursera.org/learn/object-oriented-java
The Power of Object-Oriented Programming	University of Michigan	25	NOT CALIBRATED	https://www.coursera.org/learn/the-power-of-object-oriented-programming
Object-Oriented Programming with Java	Coursera Project Network	2	4.5	https://www.coursera.org/learn/object-oriented-programming-java
Learn Object-Oriented Programming with PHP	Coursera Project Network	2	4.6	https://www.coursera.org/learn/oop-with-php
Algorithms, Part I	Princeton University	54	4.9	https://www.coursera.org/learn/algorithms-part1
Algorithms, Part II	Princeton University	63	4.9	https://www.coursera.org/learn/algorithms-part2
Applying Data Structures to Manipulate Cleansed UN Data	Coursera Project Network	2	4.3	https://www.coursera.org/learn/applying-data-structures
Python Data Structures	Coursera Project Network	2	4.3	https://www.coursera.org/learn/python-data-structures
Generative AI: Business Transformation and Career Growth	IBM	6	4.64	https://www.coursera.org/learn/generative-ai-business-and-career-growth
Generative AI: Impact, Considerations, and Ethical Issues	IBM	6	4.65	https://www.coursera.org/learn/generative-ai-ethical-considerations-and-implications
Generative AI: Prompt Engineering Basics	IBM	7	4.82	https://www.coursera.org/learn/generative-ai-prompt-engineering-for-everyone
Generative AI: Introduction and Applications	IBM	6	4.67	https://www.coursera.org/learn/generative-ai-introduction-and-applications
Generative AI: Foundation Models and Platforms	IBM	7	4.84	https://www.coursera.org/learn/generative-ai-foundation-models-and-platforms
Generative AI with Large Language Models	Amazon Web Services, DeepLearning.AI	17	4.78	https://www.coursera.org/learn/generative-ai-with-llms

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Course Name	University / Industry Partner Name	Learning Hours-by instructor	Course Rating	Course URL
Introduction to Machine Learning	Duke University	26	4.66	https://www.coursera.org/learn/machine-learning-duke
Managing Machine Learning Projects	Duke University	18	4.75	https://www.coursera.org/learn/managing-machine-learning-projects
Agile Project Management	Google	28	4.82	https://www.coursera.org/learn/agile-project-management
Project Execution: Running the Project	Google	30	4.81	https://www.coursera.org/learn/project-execution-google
Capstone: Applying Project Management in the Real World	Google	46	4.84	https://www.coursera.org/learn/applying-project-management
Project Planning: Putting It All Together	Google	33	4.82	https://www.coursera.org/learn/project-planning-google
Project Initiation: Starting a Successful Project	Google	24	4.81	https://www.coursera.org/learn/project-initiation-google
Foundations of Project Management	Google	18	4.86	https://www.coursera.org/learn/project-management-foundations
Neural Networks and Deep Learning	DeepLearning.AI	25	4.88	https://www.coursera.org/learn/neural-networks-deep-learning
Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization	DeepLearning.AI	24	4.86	https://www.coursera.org/learn/deep-neural-network
Natural Language Processing with Classification and Vector Spaces	DeepLearning.AI	33	4.63	https://www.coursera.org/learn/classification-vector-spaces-in-nlp
Natural Language Processing with Attention Models	DeepLearning.AI	26	4.36	https://www.coursera.org/learn/attention-models-in-nlp
Natural Language Processing with Sequence Models	DeepLearning.AI	21	4.49	https://www.coursera.org/learn/sequence-models-in-nlp
Natural Language Processing with Probabilistic Models	DeepLearning.AI	30	4.7	https://www.coursera.org/learn/probabilistic-models-in-nlp
Entrepreneurship I: Laying the Foundation	University of Illinois at Urbana-Champaign	18	4.79	https://www.coursera.org/learn/entrepreneurship-1
Entrepreneurship II: Preparing for Launch	University of Illinois at Urbana-Champaign	17	4.82	https://www.coursera.org/learn/entrepreneurship-2
Action-Driven Business Plan: From the 'Classroom' to the World	Technion - Israel Institute of Technology	10	4.9	https://www.coursera.org/learn/startup-entrepreneurship-capstone
Applied AI with DeepLearning	IBM	25	4.35	https://www.coursera.org/learn/ai
Rust for Large Language Model Operations (LLMOps)	Duke University	17	5	https://www.coursera.org/learn/rust-llmops